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VIEWS, NEWS AND INTERVIEWS.

The Pittsburgh Electric Club now has a membership of over 200.

An important engineering test was made last week on locomotive 870, running the Empire State Express on the New York Central Railroad. The work was done by Angus Sinclair, editor of *Locomotive Engineering*. He sat in a box on the front of the engine's cylinder and took steam indicator diagrams all the way from New York to Albany. A speed of 78 miles an hour was recorded, and the engine developed over 1,600 horse-power. The work of pulling that fast train was done on an expenditure of two and one-eighth pounds of coal per horse-power per hour.

At a recent meeting of the Thomson Scientific Club, of Lynn, Mass., Prof. William A. Anthony, of the Mather Electric Company; Prof. E. A. Dolbear, of Tufts' College; Prof. Helen Webster, of Wellesley College, and Rev. Dr. J. M. Pullman, of Lynn, were admitted to honorary membership, Prof. Helen Webster being the first lady ever admitted to honorary membership in the Club.

Gustav Pfannkuche, who was formerly connected with the Brush Electric Company, has been adjudged insane.

A 19 year old girl of Cincinnati placed a chair over a hole in the sidewalk opposite her father's house where Western Union workmen were about to put a telegraph pole. She sat on the chair until her father obtained an injunction.

Among the many stockholders of the Commercial Cable Company are: James Gordon Bennett, Blake Brothers & Company, Sir Adolphe Caron, K. C., Earl of Leicester, Comte Robert de Beaumont, Vicomte Frederic Leon de Janze, H. R. H. the Duke of Connaught, Lieut.-Gen. Sir Peter Stalk Lumsden, Sir Donald M. Stewart and Lady Alice Stephen Northcote.

Mr. Poulteney Bigelow, a contributor to *The Speaker*, tells the following story of Edison's deafness: "I asked him how it was that an inventor who had brought the telephone so near perfection could do nothing for his own hearing."

"I could if the drum were sound," replied Edison. "When I was a boy I sold peanuts and newspapers on the railway trains. One day a baggage porter lifted me from the ground by my ears—the membrane snapped, and that is how I became deaf."

The idea of filtration of the electric fluid is not altogether new. A consumer called, some weeks ago, at the station of the Notting Hill Electric Supply Company, and complained that, although the quality of the electricity purveyed to him was very good on the whole, it sometimes came through in lumps. He was assured that this could not be the case, as special provision had been made to guard against it by the use of two sets of 56 Crompton-Howell filters, which he was invited to examine.—*London Electrician.*

Berlin's Underground Railway.

The following account of the projected underground railway at Berlin is from *Glaser's Annalen:*

The city is first to be traversed by two underground lines, running north and south, and from west to east, respectively, intersecting nearly at right angles and following the main directions of city traffic. The four quadrants thus formed are to be encircled by two concentric underground rings, or belt lines. At the intersections with the lines first mentioned and at other important points stations are to be placed.

Separate tunnels are to be driven for each track. The lines will cross either above or below each other. By using loops at the ends of the diametric underground lines, switches are unnecessary, and trains can pass from one tunnel into another without interruption. Mild steel tubes of oval section, 13-32 inches thick, 11.5 feet high, and nearly 10 feet wide at their lower part, driven from 26 to 40 feet below the street surface, or 6½ feet below the bed of the Spree river, are to serve as tunnels. As the ground on which the city of Berlin is founded mostly consists of loose sand, the method of driving employed will resemble the so called Greathead system.

The gauge of the track is to be 3.28 feet. The wires of the electric conduit for supplying motive power, lighting the tunnels, etc., are placed between the rails. The trains are to consist of three vestibule cars, with a seating capacity of 40 persons each, drawn by electric motors. Power is to be generated in central stations and distributed over the whole system. The trains are to run at intervals of three minutes each, with a maximum speed of 15 to 16 miles per hour.

The underground stations are to be constructed in a manner similar to the tunnels. Several tubes of the dimensions mentioned are to be placed alongside each other and the separating walls replaced by cast iron columns. From the surface stations (either separate structures or yards and basements of suitably situated houses serving as such) passengers will descend to the stations below in elevators holding from 40 to 50 persons each.

The line to be first constructed, that running due north and south, will be about four miles long, of double track, with 14 stations. The cost of construction is estimated at $3,000,000.

Empire City Subway Company.

At the annual meeting of the Empire City Subway Company, Limited, held last week at 18 Cortlandt street, directors were elected as follows: William D. Bouchelle, John H. Cahill, Charles F. Cutler, David B. Parker and Hiram F. Stevens. The report of the company, filed with the County Clerk January 1, this year, shows its capital stock to be $1,000,000, of which $500,000 is paid in. The company is to a large extent identical with the Metropolitan Telephone and Telegraph Company, and builds the subways through which that concern lays its wires. It values its assets, including its subways, at $4,266,500.95, and has liabilities about equal to that amount.

FIG. 1.—W. T. GOOLDEN & COMPANY'S PORTABLE DIRECT READING TESTING SET.

Changes Caused by the Combine.

The Thomson-Houston Electric Company it is stated, has transferred the work on the 400 horse-power generators which it has been building to the Edison works at Schenectady. One of these generators was completed about the time the consolidation was consummated, and then it was decided, because of the better facilities at Schenectady, to transfer the work to that place. This is the only change which has been made in the manufacturing department thus far as a result of the consolidation plan. The next transfer, as a result of the consolidation, it is stated, will probably be the bringing of the arc light work from Schenectady to Lynn, and ultimately transferring the incandescent work to Harrison, N. J. The work being done at Schenectady is under the direction of the Lynn management, daily communication with the Schenectady shops being had by means of the long distance telephone. The company at present is constructing a large amount of apparatus for lighting the World's Fair grounds at Chicago. This order is very large, as the first contract is for 3,500 arc lamps, also a large number of arc dynamos. These lamps and dynamos will, it is stated, be supplied from the Chicago office of the Thomson-Houston Company, but they will be constructed at the Lynn factories.—*Lynn, Mass., Item.*

Some English Measuring Instruments.

BY CHARLES FFRENCH.

The modern Englishman is never happy unless he is under government inspection. An inspector is always at hand to prevent the simple minded John from being cheated. Indeed, so well is his safety and well being looked after that he has only within the last two or three years been allowed to light his house from electric supply mains. When permission was at last reluctantly given, John would have felt somewhat off the track without governmental aid and advice if he had not had at his elbow the ubiquitous and almighty fire office inspector. This gentleman, at least, knew his own mind (not a very extensive knowledge, perhaps), and, since the prevention of fire was his end and aim, he insisted on three things—you *must* put your wires in casing, inflammable wood casing, if you like, but still casing; you *must* mount your fittings on incombustible materials, no matter if they are hygroscopic or not, and, finally, the insulation *must* amount to so many megohms. The fire office man was not quite clear whether a megohm was a current or a self-induction, but he knew it was good to have plenty of it; the fact that the supply companies insisted on megohms gave him confidence. And so wiring contractors and fire inspectors and other interested parties wandered around hunting for megohms with $200 Wheatstone bridges and galvanometers and a leaky Leclanché cell or two. No two men ever agreed about the number of them when caught, and it generally took longer to test the wiring in a house than it did to put it in. But a time arrives at last when even a British worm will turn, and Messrs. W. T. Goolden & Company, of London, Eng., having a large number of wiring contracts always in hand, determined to provide themselves with a portable and rapid means for testing insulation resistances. After some experimental work, they succeeded in turning out a direct reading ohmmeter graduated to read from 0 to 5 megohms on a clear open scale.

To say that the ohmmeter was originally invented by Professors Ayrton and Perry is only another way of calling it a piece of electrical apparatus. Abandoned by its parents, the ohmmeter has been adopted and trained into a practical and useful instrument by its foster father, Mr. Evershed, the manager of Messrs. Goolden's instrument factory.

In principle an ohmmeter consists of two coils at right angles surrounding a pivoted magnet, the position of which depends only on the ratio of the currents in the coils. Now, if one coil is in series and the other in parallel with a resistance, the deflection of the magnet will depend only on the value of the resistance, and if an index is attached to the magnet and made to range over a scale on a dial, which is divided so that the index reads off the resistance in ohms (without any calculation or logarithms, or nonsense), we shall have a practical ohmmeter.

The difficulties actually met in applying this principle to insulation tests were somewhat formidable; first one coil, the so-called current coil, had to be made to give a good

magnetic field, with the very minute current to be got through two or three megohms; in the instrument illustrated here, this coil contains over 20,000 turns of the finest silk covered copper wire. Next the magnet must be astatic and must be so light and pivoted so freely that friction is negligible; yet the parts of the instrument must be strong enough to stand rough usage by wiremen and fire office inspectors; no silk suspension is or can be used. The instrument is fitted into a strong teak case, 6x6x5½ inches and weighs six pounds. Having secured an accurate and handy ohmmeter, Messrs. Goolden next turned their attention to providing a portable magneto or dynamo, capable of giving at least 100 volts at the ohmmeter terminals, as in their opinion tests made with five and ten volts were of purely academical interest.

Why a dynamo? Why not a battery? Certainly use a battery if you like. Small silver chloride cells are now made giving about 1.7 volts and occupying a space of 1x1x4 inches, and as you will only want about 60 cells for 100 volts, you can get them into a box 10x6x5 inches inside, and they will cost you, in England, about 65 cents apiece, or, say, $50, including box and fixings. And how long will they last? Perhaps a month, and then one day you can't get any electromotive force and you pull the whole show to pieces and spill the acid around and imperil your salvation. Messrs. Goolden's first magneto generator had an old Siemens' shuttle armature. This armature gives a violently fluctuating current and causes large errors when used with the ohmmeter for testing cables having any electrostatic capacity—even the capacity of damp wires is enough to vitiate the results—hence the generator illustrated above. It has a drum armature with a special winding and a commutator arranged to add all the coils in series so as to secure the largest electromotive force with the least amount of wire. The machine is excited by four permanent magnets, and when the armature runs at about 1,100 revolutions—70 revolutions of the handle per minute—it delivers 100 volts at the ohmmeter terminals. Any one can get 200 volts out of it by speeding up to about 150 revolutions or so. The generator goes into a teak case 7x7x7¼ inches and its weight complete is 10½ pounds.

Measurements of insulation resistance by means of one of these portable testing sets are exceedingly easily and quickly made. The generator being coupled with the ohmmeter and the latter connected to the circuit under test, a few revolutions of the generator handle suffice to bring the index to its reading, and the resistance is read off in ohms or megohms. The apparatus serves to measure the insulation resistance of house wiring, street mains, armatures, field magnet coils, and, in short, any and every kind of electrical circuit, and it pays for itself in a few months in the enormous saving of time and worry wherever such tests have to be made. The Evershed portable testing set has rapidly come into use throughout England. It is no exaggeration to say that every English manufacturing company, electric supply company, or wiring contractor of any standing, finds one or more (generally more) of these sets absolutely indispensable to business.

OBITUARY.

Augustus Allen Hayes, who died recently in Paris, was secretary and acting vice president of the Brush Electric Company in 1880. Mr. Allen had acquired a considerable reputation as a writer of short stories.

Charles E. Locke, an electrician well known among the Providence and Pawtucket fraternity, died last week at Glenlock Falls, N. H., of consumption. Mr. Locke had been ill a long time, and his death was not unexpected. For several years he was engaged as agent of the Rhode Island Electric Protective Company.

George Taintor, father of Charles Taintor, of Washington, the inventor of the graphophone, died at the Massachusetts General Hospital, in Boston, recently, aged 70. Until recently he was employed by the Walker & Pratt Manufacturing Company as a fancy pattern maker. He made several inventions, including the Taintor damper, the automatic hand tool and borer, and a paper file made wholly of wood. An invalid widow, a son and a daughter survive him.

Hassen Ben Ali in Africa.

Si Hassen Ben Ali, the Moor, who went to Africa to secure exhibits for the World's Fair, has been heard from in the wilds of the "Dark Continent," says the New York *Advertiser*. A passenger on the steamship "City of Berlin," which arrived yesterday, brought documents from the explorer which show what progress he is making and the methods he is employing in securing the African exhibits.

Si Hassen Ben Ali obtained a valuable concession from the World's Fair Committee for the establishment of a Moorish village during the Fair and a combined African show. When he went abroad a few months ago he took with him, among other things with which to startle and amuse the natives of Africa, a complete telephone outfit, a phonograph loaded with popular airs of the day, negro dialects, speeches and brass band and banjo recitations, a powerful electric battery, several of Edison's talking dolls and an outfit for sinking artesian wells. With the latter apparatus he intended to pulverize the natives by practically "wringing water from a rock."

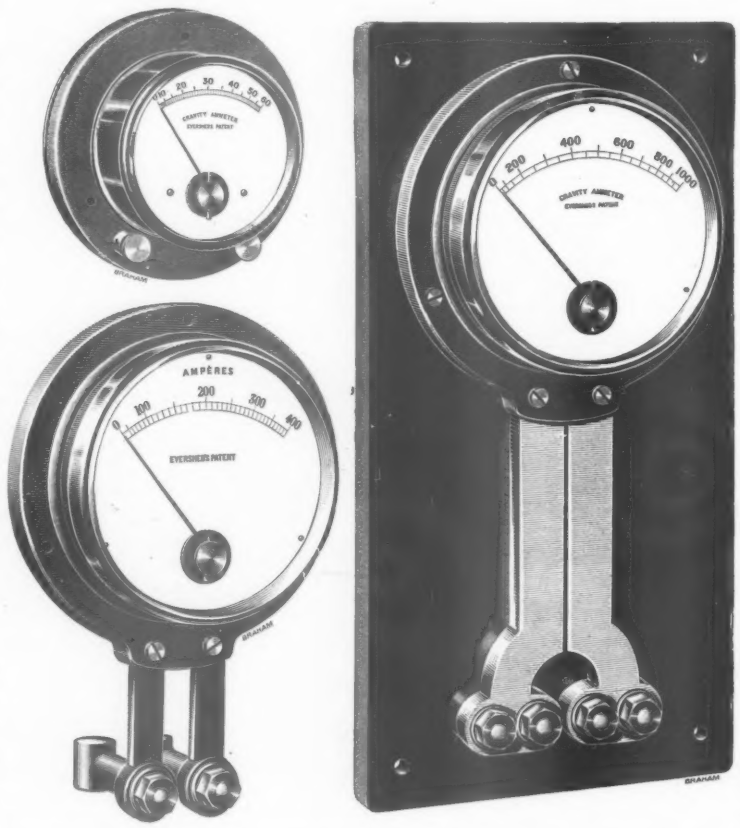
With these inventions Si Hassen, who has shown considerable enterprise in the undertaking, argued that he could make better progress with the natives. He thought he could win them over with these peaceful demonstrations, which would appear to them all-powerful. "Where an armed force would meet with opposition in Africa," Si Hassen said, before his departure, "I can go single-handed among the wildest of the natives, armed only with those harmless inventions and get permission to go where I please." From all accounts the explorer is actually demonstrating that the phonograph and talking doll are more powerful than a Krupp gun.

When last heard of Si Hassen was at the court of Moulay El Hassen. Before exhibiting the inventions he made a speech, in which he said he was an envoy from Allah sent to do good among the people of Africa. Then he trotted out the phonograph. When the natives heard a German band give a rendition of "Annie Rooney" and "Mary, Take In the Wash," they fell back in awe. A brass band is as novel a feature in Africa as a Bowery dentist, and they did not appreciate the significance of the performance; but the harmony, coming as it did from a mysterious somewhere, thrilled them and had the desired effect.

Then two giants were induced to take hold of the insulators of the electric machine and a current was sent coursing through them. Two more surprised natives were never before seen in Africa. The other natives were spellbound by the sight of the two strongest men in the village kept under restraint by an unseen power, and compelled to get down on their knees at the will of the operator. When they were released they fled toward the coast terror stricken, and from all that is known up to the present writing they are "fleeing" yet.

When the talking dolls were produced the excitement of the natives was intensified. The dolls did Lydia Yeamans' famous "baby" act with faithful precision, and then tried to outdo Carmencita. The savages regarded the dolls as things of life, and, through their interpreter, said they resembled the small people found on the other side of the Atlas mountains.

The natives believed that spirits were locked up in the mysterious boxes which Si Hassen carried, and they regarded him as a spirit from the spirit land. When he asked permission of the chief to penetrate into the interior the request was speedily granted. The chief insisted on tendering Si Hassen a royal reception, after which he took his departure. When he returns he will have obtained some valuable specimens from the Dark Continent.



FIGS. 2, 3 AND 4.—W. T. GOOLDEN & COMPANY'S VOLTMETER, ALTERNATE CURRENT AMMETER AND GRAVITY AMMETER FOR 1,000 AMPERES.

An Electric Bell Fraud.

Charles F. Goodenough and James R. Goodenough, brothers, were arrested recently at St. Louis, charged with using the United States mails to defraud. Post Office Inspector Williams has been working on the case for a long time. The St. Louis Automatic Electric Bell Company, composed of the prisoners, has been advertising in country papers that it had an electric bell that required no battery and was warranted not to get out of order. The price of this bell was $1.40, and a large number of orders enclosing money were sent to the "company." No bells followed the remittances and letters of complaint poured into the inspector's office, which resulted in the arrest of the men.

Methods of Electrically Controlling Street Car Motors.

REPORT OF THE DISCUSSION OF MR. PARSHALL'S PAPER BEFORE THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS, APRIL 19, 1892.

In the ELECTRICAL REVIEW, April 30, 1892, appeared the paper of Mr. H. F. Parshall on the above subject. Below we give the discussion on this important and timely question.

Mr. Chas. Hewitt: My experience has been mostly with the commutated fields, but at the same time I have had the privilege of examining a good many cars using the external rheostat, and in every case, whether a double reduction motor or a single reduction motor or a gearless motor is used, it takes more watts to accomplish the same result with a car using an external resistance than with a car which uses simply the commutated fields. Every departure which has been made from the high efficiency double reduction motors has been a step backward, so far as efficiency is concerned; the gearless motor takes the most energy of all to accomplish the same result. The single reduction motor comes in between, and the high speed motors are the most efficient of all.

Mr. Townsend Wolcott: In regard to the efficiency of double, single reduction and gearless motors, as I understand it, the efficiency measured at the car wheel does not show the discrepancy the gentleman spoke of. Of course, the power delivering at the end of the motor shaft would be greater and the efficiency would be greater on a high speed motor; but when we consider all the gear friction, as far as I have been able to ascertain, the efficiency is not so greatly different. In fact, the gearless motor people claim that they run with the highest efficiency in some cases, which they do not claim for all work, but under certain conditions they claim to run with as good an efficiency as with double reduction motors.

Mr. Chas. P. Steinmetz: If we wish to speak upon the efficiency of motors, we should decide first what we mean by this term, for although electrical engineering has very exact methods of determination, there are so many meanings for efficiency that the term usually means nothing. The one measures the resistance of the motor, and finds, say, one ohm. With 15 amperes current this means a loss of 15 volts, or three per cent. at 500 volts line potential. Then he begins to say what a beautiful motor he has of 97 per cent. efficiency. But he does not take into account that he loses, perhaps, 20 per cent. by hysteresis and foucault current, loses 10 per cent. by friction in the bearings, and wastes 30 per cent. besides by grinding the gears to dust, and gets then only a mere nothing to the wheel axle. Another one desires to proceed more correctly, and measures the "mechanical efficiency" of the motor. That is, he applies a brake to the armature shaft, measures the electric power sent into the motor and the mechanical power taken off from the motor shaft, and finds 87 per cent., "a very good motor." Whether in practical service under the strain of the gear thrust, the friction is the same, and how much he loses in the high speed gearing nobody knows.

I have no exact data of the losses in the high speed gears of the street car motors used here; I remember only one case on an English system of geared street car motors, very carefully cut zig-zag gears, which certainly do not waste much more power than the usual spur gears; there the loss amounted to about 40 per cent. In the data given on the efficiency of street car motors this loss is generally *not* included. And especially street car gears must be very wasteful, not only because of the rough usage they are exposed to when going through rain and dirt and over dusty roads, but from the fact that the transmission of power by gearing is at its best only when the height of the gear teeth is negligibly small compared with the radius of the gear. But in this high speed gearing the pinion must necessarily be small, and then the height of the teeth is very perceptible compared with the radius of the pinion. In this case the gearing does not transmit with a fixed, but with a varying, ratio; the teeth touch each other first with their heads, slide over each other and come out of impact when touching each other with their feet. That means that the ratio of transmission for each tooth which passes another varies between the ratio of the maximum and the ratio of minimum radii of impact. Suppose the pinion has 18 teeth, the motor revolves

with 1,200 revolutions. Then 19,200 times per minute the leverage of the transmission goes up and down. Either the speed must vary, fluctuate as often—which is out of the question because of the momentum—or, as many times per minute the gears come out of impact and in again, alternately the one or the other leading. Every time they come in impact again, 19,200 times per minute, it gives a blow against the teeth. This is what causes the rattling and hissing noise of high speed gearings, and their rapid destruction. That the loss of energy in the gearing is considerable we can see without any tests, if we consider in what very quick time steel and phosphor-bronze pinions are ground to dust and raw-hide gears torn to fibres. With regard to gearless motors, I have seen a number of test curves of such a motor, which showed an efficiency of 80 per cent., and considering the absence of the loss of energy in the gearing, I really cannot see how the double-geared motor can possibly be more efficient.

Mr. Thorburn Reid: The practical street car man has an exceedingly simple method of getting the efficiency of the street car motor. He does not bother his head very much about the resistance of either the armature or the field. He does not know how much friction there is in the gear, but he runs his car and he sees how much current it takes to drive and how many volts electromotive force there are on the terminals. He multiplies the two together and gets the number of watts to drive his car on the road. He gets another car and tries that and sees that the one that takes the smallest number of watts has the best efficiency. That is all that is necessary for his purpose, and I think that for our purposes that is all that is necessary. If a motor draws a car with the least amount of energy, that is the best motor we can get for the work. Mr. Hewitt told us that the double reduction motor appeared to be the most efficient, the single reduction the next, and the gearless motor the least efficient. I suppose that he means by that just what the practical street car man would mean—that it takes the most current to drive a gearless motor, less for a single reduction and less for a double reduction. If I remember Mr. Short's paper, read, I have forgotten where now, he gave three curves, as I remember it, for efficiency of street car motors in which he put the gearless motor as using the smallest amount of energy of the three, the single reduction motor next and the double reduction motor as using the most.

The Chairman: In justice to Mr. Parshall, I, perhaps, should show this plate and read the following note which he has sent about it, which has only recently been received:

"The three curves in Fig. 5 are for single reduction motors with commutation fields. No. 1 is for a 25 horse-power; No. 2 for a 15 horse-power, and No. 3 for a 20 horse-power motor. The pull at the car wheel for the more important points is given, since without this such curves of efficiency and horse-power of street car motors are of but little value. It may be well to state that it has been found impossible to increase the limits of the high efficiency part of the curve by modifying the construction of the armature core so as to diminish the losses by hysteresis and foucault currents."

Mr. Hewitt: I think the paper Mr. Reid referred to was read by Mr. Short before the Chicago Electric Club, and the portion of the paper that misled Mr. Reid, and perhaps others, is the fact that Mr. Short started with his double reduction motor, whose maximum efficiency is no higher than the maximum efficiency of his gearless, viz., 70 per cent. He first tested the motor without gears. He then put on a single reduction of gears and tested again. Of course, he got a lower efficiency. Then he put on another reduction and tested again and, of course, he got a lower efficiency still. Now, we all know that every reduction in gears gives a loss in power. The misleading portion is that he uses a motor of very low maximum efficiency. A well designed double reduction motor, with commutated fields, starts off with an average efficiency of 85 per cent. and a maximum efficiency of 88 per cent. to 90 per cent. Allowing 15 per cent. loss in gears, as shown by Mr. Short, we get an *average* efficiency at the car axle of 70 per cent., which is as high as the *maximum* efficiency of Mr. Short's gearless motor. We can discuss here, theoretical efficiencies of motors, but so far as the street railway is concerned, the commercial efficiency is the only one to be considered. Any road which is worthy of the name of an electric road has definite routes, and puts cars on those routes to run on schedule time. It will not let its motormen race or run ahead of time or behind time. So that, no matter what system a car belongs to, it has given to it a certain service and it is the car which does that service with the least expenditure of energy (repairs being equal) which is the most efficient to the railroad company. Crosby and Bell in their recent book show that the coal consumption is comparatively a small part of the operating expenses of a road, but there is another point which is not stated, I believe, in connection with this extra energy required to drive the single reduction and the gearless motor, and that is the vastly larger power plant required to be operated. I know very well that with the No. 6 motor on an average road we could easily run 12 cars with a 100 kilowatt dynamo, whereas, with single reduction motors we can run only eight, and with some motors only five or six cars. Now, it makes a great difference, whether you have got to install two 100 kilo-dynamos to do a certain duty or one. It is not only the actual cost of the coal pile and the actual cost of attendance, but it is the increased cost of the plant. Power plants have got to be built of almost double the size now that they were two years ago with the No. 6 motor. A prominent engineer of a railroad syndicate told me, after testing 35 roads, that they actually could not afford to build the stations to provide current for the motors now made.

Mr. Wolcott: In regard to the power consumed by gear, Mr. Hewitt correctly stated Mr. Short's method. But, as I remember, the Franklin Institute made some tests some years ago with reference to the efficiency of gearing. The best possible spur gear gave 90 per cent.—this is a laboratory test. With two reductions, that is 81 per cent. Now, if the motor has 85 per cent. efficiency, as Mr. Hewitt mentions, that gives us 68.85 per cent., call it 69 per cent. efficiency, and the gearless motor started with about the same; about 70 per cent.

Mr. Hewitt: That was the highest efficiency, not the highest average. The double reduction motor will average about 85 per cent.

Mr. Wolcott: Now, the chief difficulty with the gearless motor, to my mind, is a mechanical one. I have not seen any gearless motor that suits me all around for mechanical reasons. The Short motor drives cars with a sort of a lathe dog arrangement. It always seemed to me that there would be considerable loss on that. Some of the motors drive with side-rods like a locomotive. Of course, one difficulty in putting an armature right on the shaft is the trouble of getting it out in case anything is the matter with it. With side-rods you have got to have a truck much more rigid. One of the greatest improvements in street cars of late years is what is called flexible gearing. Four wheels are always resting on the track. If you connect up with side-rods, it is all right on the straight track; but when you come to curves I think you will find there is a great deal of the power wasted in that way. It does not seem to me so much an electrical problem as a mechanical problem.

Mr. Hewitt: I beg to differ from the gentleman on that very last statement. If you will notice the curve published by Mr. Short, you will see that it falls off very gradually, so that the average efficiency in the gearless motor is very low, somewhere about 45 per cent. We can get with the double reduction an efficiency of 60 to 70 per cent. for the whole car equipment. With the gearless we go down to 45 per cent. or 50 per cent.

Mr. Steinmetz: I have not read Mr. Short's paper, but I am of the feeling that the gearless motor which gives an average efficiency of 35 per cent. must be a remarkably poor motor. I know that the average efficiency of a well designed gearless motor can be brought to as high as 75 per cent. Tests made by an independent railroad company on such a gearless motor showed that the highest efficiency reached is a little over 80 per cent., and, compared with other single reduction motors, what struck me as most remarkable was, that the efficiency curve was just very flat and over a wide range beyond 70 per cent. But I think that this falling off of the efficiency curve in the geared motor is more due to some defect in the design of the motor and is not essential in the principle of double reduction or single reduction or gearless motor. But 35 per cent. efficiency—that is a very poor motor, no question about that, and entirely drops out of consideration. Then there was another point. What was the objection against the transmission of the power by connecting rods?

Mr. Wolcott: Requiring the truck to be less flexible. In the modern street car gear the two axles can move.

Mr. Steinmetz: Yes, but in the gearless motor with connecting rods they can move just as well, or even more freely.

Mr. Wolcott: The best street car gears have several improvements. They will move to and from each other. That certainly cannot take place with side-bars and they can be twisted.

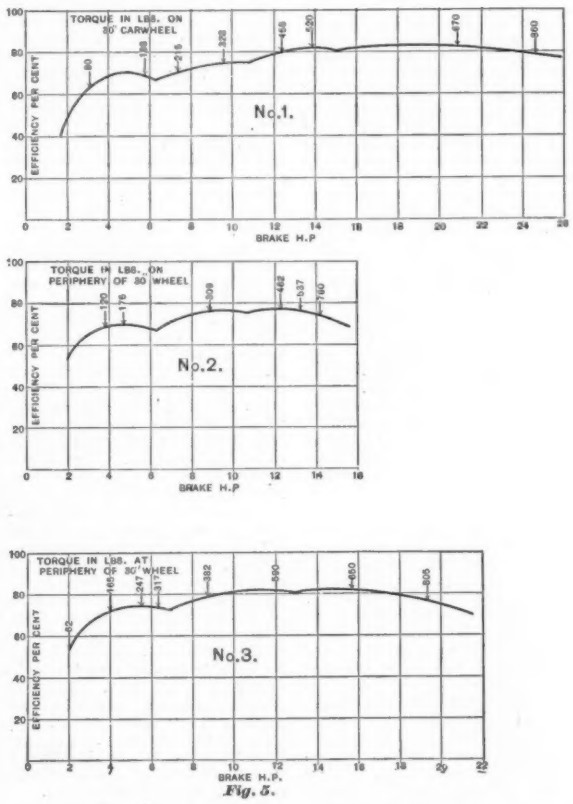


Fig. 5.

METHODS OF ELECTRICALLY CONTROLLING STREET CAR MOTORS.

Mr. Steinmetz: Locomotives have been built in that manner, so that there is no mechanical hindrance to provide even for this, but that no need for it has been found.

Mr. Wolcott: It seems to me that even that would interfere somewhat with flexibility of the arrangement. You certainly would require the dissipation of some energy there.

Mr. Steinmetz: I cannot see that. Suppose the motor to be rigidly connected with the car body, but resting, together with the car body, on springs. Then the motor shaft can go up and down and oscillate freely with the car body, while the wheel axles can twist and come out of parallelism with each other and with the motor shaft, just as they like, or, rather, as the condition of track and car cause it, without interfering with the action of the connecting rods, hence without dissipation of energy, all three axles moving in parallel vertical planes.

Mr. Wolcott: If the motor shaft and the car axle are in parallel plane, how can they move out of parallel?

Mr. Steinmetz: Motor shaft and car axle can take any inclined position against each other and nevertheless remain in parallel vertical planes, moving up and down and twisting with regard to each other. The fact is, there is no dissipation of energy, because there is no wearing out, for, after a year's continuous and daily running, I found a pair of such connecting rods not worn at all. Besides, it is exactly the same method of transmitting the power to which steam railroading has been led by 70 years' practical experience.

Mr. Hewitt: I would like to ask Mr. Steinmetz if the test he refers to was made on a car in actual service and whether that car was operated by a rheostat? I feel confident in saying that if we can furnish gearless motors that will operate with an *average* efficiency of 75 per cent. in actual practice, there never will be another geared motor sold. I think there is another point in Mr. Parshall's paper here which gives an inkling of the cause of this low efficiency. At the top of the second page he says: "The average horse-power exerted by a street car motor at the car wheel probably does not exceed 20 per cent. of the maximum it is expected to do in starting the car under the various conditions encountered." I am prepared to say that that is rather overstating than understating the fact. If we examine the dynamo curve—a good dynamo will give a high efficiency from half load to full load, but when it gets below half load it drops very suddenly. The trouble in street car work is to get a high efficiency under average conditions.

Mr. Steinmetz: The tests were made by the West End Street Railway Company in Boston and the motor was working with a commutated field—not with a rheostat—the gearless motor that I referred to.

Mr. Chas. G. Curtis: I am rather surprised to hear those who have evidently had a good deal of experience with railway motors express themselves so strongly against gearless motors. There seems to be an idea that it is impossible, even by the use of enough copper and iron, without reference to the weight of the machine, to accomplish the same result at a slow speed that is accomplished at a high speed. Now, why should not a gearless motor, which revolves at one-tenth of the speed of the old style double reduction machine, be made to give the same power as the double reduction, provided enough copper and iron is put into it, provided the cross-section of the iron is increased, and provided the number of turns of the armature is sufficiently increased? I know of a gearless motor which was operated for several months, and tested by some experts who were not interested in any way, and who found by comparison that it took 16 amperes to make 18 miles an hour, while one of the regular Thomson-Houston cars required 28 amperes to make 17 miles an hour. The Thomson-Houston car was one that had been in use about six weeks without any renewal of the gear, and, therefore, the gears were probably more than half worn out. Then the test was made with another car, where the gears had been used about two weeks, and it was found that the car required about 25 amperes. Some Stevens Institute young men made some tests on the same road, a long series of tests, and they found that the cars required about 26 amperes on an average, while this car that I speak of, that was operated by a gearless motor, ran along invariably with as low as 16 or 17 amperes, and the average of a long series of tests made it 16 amperes as against 28; which is a saving of about 40 per cent. I do not see any reason why it should not be so, and when the characteristics of the machine are known, it is perfectly evident that it must be so. It is simply a question of having enough iron and enough turns on the armature. Now, the increased turns on the armature would result in an increased resistance, were it not for the fact that a larger wire is used. The same is true of the field. But it must be remembered that with the old double reduction machine, the field required a good many ampere turns to bring it up to saturation, and in the new machines, such as those made by the Thomson-Houston Company to-day, the ampere turns are less. The resistance of this machine was about $2\frac{1}{10}$ ohms, and my impression is that the resistance of the Thomson-Houston double reduction machine is about two ohms. I know that the armature is half an ohm. I think there are about 40 pounds of No. 12 wire on each of the field spools, and that, I figure, is about two ohms. The weight of this machine was 2,400 pounds, and the armature had no objectionable heating at 22 horse-power. We never ran it at 22 horse-power, running a car alone, but we dragged trailers with it and tried it up grades, and it would stand 22 horse-power easily enough. Probably 300 or 400 pounds could be knocked off that weight by a judicious re-arrangement of the metal. As I say, the diminution in efficiency is purely a question of increasing resistance. All the other factors must be better in the gearless motor than in the geared motor. Hysteresis and foucault currents, which are the only other losses that amount to anything, are reduced by the diminution of the speed, and in direct proportion to the reduced speed, except for the fact that the number of poles is increased. In regard to the difficulty of communicating the rotation of the armature to the wheels, which Mr. Wolcott speaks of, we did not notice any difficulty of that kind at all. On the other hand, we rather smiled at the perfection with which the mechanical part of it worked. The power was trans-

mitted by a face plate carrying flat pins, and those pins stood between rubber cushions and the torque of the motor operated to compress one set of cushions or the other set, according to which way it is going. Of course, when the two pins were in a vertical position, if you should pass over a rut in the track the motor would descend and the face plate, with its pins, of course, would slide down between the cushions—probably never exceeding half an inch. The cushions had cast iron caps, which protected their ends, and after the motor had been in use several weeks there appeared some wear on those caps. Of course, any question as to loss of efficiency was disposed of by the speed and by the amperes and volts. As Professor Short was saying, in his last paper, the efficiency of gearing seems to increase enormously with the speed. That is shown in the peculiar phenomenon which takes place in the Thomson-Houston double geared cars. They operate their cars on what they call a loop. In order to get the maximum speed they throw out some of the field winding. Now, when they do that, it is done with one throw; that is to say, there is only one section of the field that is thrown out. The power comes on suddenly and the car jumps ahead, but there seems to be very little difference in the speed, whether there are trailers on or not. In other words, the gearing seems to be the limiting element. Beyond a certain limit the gearing consumes an enormous amount of power. Below that speed it consumes about 30 per cent. My experience is that those gears, with the usual amount of dirt, will consume 30 to 40 per cent. at a speed not over 15 miles an hour. I have seen two 15 horse-power Thomson-Houston motors with passengers hanging onto the steps and making within two miles an hour of the same speed that it would make with no trailing cars on and no passengers in. I should think there was a difference of two miles an hour out of 17. My experience is that the main difficulty with the whole problem is to get a mode of running at a slow speed or a half speed, which is reasonably efficient, and at the same time be enabled to run at full speed. The only method which has been devised, which is at all practical, is that pursued by the Thomson-Houston Company, which I have referred to, which consists in cutting out some of the field-winding and diminishing the strength of the field. But that is open to the objection that you cannot carry it beyond a certain point, because you get self-induction in the armature.

Mr. Hewitt: The last gentleman seemed to infer that I was arguing against the gearless motor *per se*, which is not the case. I merely tried to bring out facts as they actually exist on roads as they are running. I spoke of the gearless motor as shown in Mr. Short's paper because it is to be inferred that he has chosen a fair example to illustrate that paper, and he shows an average consumption of 24.5 amperes, including zero readings. It is very misleading for us to compare the consumption of amperes alone, because of the variation in electromotive force. The last gentleman said he tested one motor with something like 16 amperes, another one 25 amperes; but the difference in electromotive force may be very great. With 16 amperes you may have 500 volts; with the 28 amperes you may have 320 volts. The watts are the same in each case. The only safe comparison we can make is the actual watts which the car consumes in doing its work. Mr. Short's paper shows that the motor he refers to gives an average consumption of 13.8 electrical horse-power. That is an actual test and I know of no other gearless motors in actual street railroad practice that have done any better. I do not think anybody is prepared to say that the Westinghouse motors have exceeded that in economy. In fact, at Pittsburgh, I am told that they have shown a much larger consumption of power. I do not know what motor the gentleman is referring to; therefore, I cannot speak intelligently about the test he refers to, but certainly no published tests show the efficiency he speaks of. If he has a motor which will show that efficiency in actual operation it is as good as any single reduction motor on the market. But even at that figure, it cannot compare with the efficiency of the double reduction motor.

Mr. C. G. Curtis: I only meant to speak of this motor as a matter of general interest, not as a result that has been accomplished which is remarkable, or anything of that kind. When I spoke of the amperes required, a comparison of 16 to 28, I, of course, took into consideration the volts. I mean that there was not enough difference in the volts to affect that. One was 480 and the other 465, or nearly 470, so that it made a difference of about two and one-half per cent., whereas the total difference in the amperes was 43 per cent., I think, so that the net result was about 40 per cent. gain. As regards Professor Short's gearless motor, I was not speaking of it in comparison with that, nor do I see why the question should be judged scientifically by a consideration of any particular motor. From the theoretical point of view there is no reason why the gearless motor should not be just as efficient as any other kind of motor, provided you can get on enough copper to make the resistance as low. Now, if Professor Short's motor is as inefficient as he says, it may be due to bad construction of the armature which results in very high foucault currents. But it is more likely due to too high resistance. He has got a large amount of wire on the field and a large amount of wire on the armature, and those two things combined make a considerable loss. But even then I do not see why he should get such a loss as he states. It takes an immense resistance there to make a very much greater resistance than they have in the old style machines. It must be borne in mind that in this new machine the field, which consumes more energy than the armature, due to its resistance, is very much reduced. The field in the new Thomson-Houston machine is operated with one coil. This coil has a cross-section, which is about square, and the machine weighs 2,300 pounds. I saw one the other day in operation in Pittsburgh. The superintendent told me he had it operating a snow-plough with over 100 amperes on the two motors steadily and there was no injurious heating, and he was under the impression that he had had it operating as high as 130 amperes for over an hour. That, of course, is an enormous current for the 25 horse-power machines. But, as I say, by adopting the slotted form of armature, which reduces the resistance of the magnetic circuit, they have succeeded in reducing the amount of ampere turns on the field, so that they can get along with much less resistance. If there is any other cause of efficiency in a motor I should like to hear it mentioned. Certainly the loss from friction on the bearings is not worth speaking of. A gearless motor has an advantage in that respect over any other form of motor for the simple reason that the torque is transmitted to the wheels symmetrically with respect to the axle. There is no thrust tending to throw the armature shaft out of its position. Whereas, in the ordinary geared motor, there is a tremendous thrust. But even with that thrust the friction is so little with the oil bearing that it is hardly worth speaking of.

Another point, where you have a hollow shaft which necessitates a shaft probably from five to six inches in diameter, it makes a very large bearing and the distance that the bearing surface travels is very great compared with the ordinary bearing. But when you come to compare it you find the ratio is about two to one in diameter. Now your speed has come down to one-tenth, so you are five times as well off as you were before. It is only a question of keeping the bearing oiled. That can no doubt be accomplished by using a saddle bearing brass, such as that in an ordinary car box. I do not suppose the loss due to friction on the bearings is one per cent. There is no reason why that the resistance should not be reduced to a sufficiently low point. It is simply a question of copper. In this machine, No. 10 wire was used instead of No. 12. No. 10 is pretty nearly twice the cross-section of No. 12, and the turns were about 2½ times as many. The consequence was that the resistance of this armature was about 1½ times that of the old Thomson-Houston machine. But the Thomson-Houston is very low, indeed; it is one-half an ohm, and that is one reason why the Thomson-Houston machine has been so successful. It has got a margin there. I have seen two of those 15 horse-power Thomson-Houston machines drag three trail cars, and do it hour in and hour out in Summer, with the thermometer up to 90, at a speed of 16 miles an hour, and that is half again as good as any other kind of moter I have seen working on a car.

Mr. Chas. P. Steinmetz: I cannot see that the resistance of a gearless motor must be any larger than that of a high speed motor, for a slight increase in the size of the armature wire easily brings the armature-resistance down. For instance, the gearless motor I referred to had an armature resistance of three-quarters of an ohm, using wire No. 9 B. & S. gauge. The field was commutated, and, when in parallel, had a little less than one-half ohm resistance, giving a total motor resistance of somewhat less than 1¼ ohms. The foucault currents in the armature amounted to some 20 watts. Hysteresis was considerably larger because of the high magnetization used, and reached a maximum of 124 watts. The loss by the resistance of the motor depends upon the current, and can easily be calculated by the figures given above. The system I referred to was the Eickemeyer-Field system, as used in Toledo, Lynchburg, Yonkers, etc. In Toledo they had these gearless motors and double reduction motors running at the same time, on the Consolidated Electric Railway Company, and there the station superintendent found that if he only run gearless motors, he consumed less coal under the boiler of the steam engine than when he run double reduction motors.

The Chairman: Were not the motors that you referred to, that were tried at Toledo, those in which it is said that the inside helix excites the armature direct instead of being excited by the field magnet polarity?

Mr. Steinmetz: Yes, sir. The magnetizing helix directly and closely surrounds the armature and, consequently, there is not only no magnetic leakage, but the length of the magnetic circuit the least possible. In consequence thereof, with a given weight of material, the cross-section of the magnetic circuit and, therefore, the magnetization can be as much higher. For instance, the motor I referred to, with the field fully excited, drives 24 million lines of magnetic force through the armature. Besides, if the field coil surrounds the armature, the height of the whole motor is very little more than the diameter of the armature. This has the advantage, again, that the lowest part of the motor is still 4½ inches above the ground, and, nevertheless, only 26 inch car wheels—the ordinary horse car wheel size—are used.

Mr. C. G. Curtis: What speed do you run at.

Mr. Steinmetz: Well, the lowest speed is about six to seven miles; that is with commutated fields.

Mr. Curtis: What speed was this loss of a hundred and some odd watts?

Mr. Steinmetz; I did not measure it for a certain speed, but I followed it over the whole range of speeds; this loss by foucault currents and by hysteresis depends upon the speed, decreasing for slow speed because of the smaller number of reversals, and decreasing for high speed, also, because of the decreasing magnetization. The figures I gave correspond to that speed, where the loss is maximum. Indeed, it can never be 24+124=148 watts, because the maximum of foucault currents does not take place at the same speed as that of the hysteresis loss, the one varying directly proportional to speed and to the one-sixth power of the magnetization, the other following the square law.

Mr. Hewitt: What Mr. Steinmetz said, and what the Chairman said about the magnetization of the armature on the Eickemeyer motor is true, also, in a large measure, of the Edison motor and the Thomson-Houston motor. The field coils overlap the armature and form the pole piece, but still they are not as efficient as the double reduction motors. I do not pretend to deny that the gearless motor can be made as efficient as any other motor, provided we have unlimited space and can put unlimited iron and unlimited copper in it. On a street car we have got a limited space, and we have got to conform to that space, and that is the reason why, perhaps, more iron and more copper are not used. Another thing, if we use more iron and more copper we would have a more expensive machine. That is another very serious point. Mr. Short's motor, I believe, runs about three inches from the ground, two or three inches; I am speaking from memory and am not positive. But we certainly should not run a motor nearer than three inches to the ground, because we are liable to strike something—a loose paving stone or piece of iron. Three inches is complained of by railway companies. And when we start with 30 inch wheels, or even 36 inch wheels, we have very little space, but when we come to locomotives for high speed, 100 or 120 miles an hour, and can use 40 inch wheels and larger, we can have all the space needed. It seems to me that, so far as street railways are concerned, we have reached our limit with the single reduction motor, and with them I would like to see a better efficiency than we are now getting.

Prof. F. B. Crocker: This question of the relative efficiency of single and double reduction gear motors is really a question of the relative efficiency of motors at different speeds, and is an old problem. Take a given motor, of course, the lower the speed the less the losses are. I have made a list of them: Foucault currents, hysteresis, friction and air resistance are all reduced at lower speeds. The only losses that are increased are the C^2R effects, that is, the heat due to the electrical resistance. There seems to be a great confusion as to whether we can run a motor at slow speed and get a reasonable efficiency. Now, as I say, the only losses that are increased at low speeds, other things being equal, are the resistance losses, and, as Mr. Curtis says, it does not require any great increase in the size of the wire to make up for this. For instance, No. 12 wire increased to No. 10. A machine wound with a No. 10 wire does not occupy much more space than one wound with No. 12, and that yet makes enough difference to materially reduce the resistance, and, in the case Mr. Curtis spoke of, it almost made up for the increased length of wire. The facts that the foucault currents and hysteresis are materially reduced at low speed is quite a saving. Another point Mr. Curtis spoke of —the reduction in the thrust on the bearings in gearless motors—is also quite important. Unfortunately, as Mr. Hewitt says, we have to have some means of allowing the car to go at slow speed. We are supplied with 500 volts whether we are running at fast or slow speed. Therefore, we have to introduce external resistance or resort to some peculiar method of overcoming this difficulty. But the single reduction gear or double reduction gear motors, when standing still or running at low speed, require practically the same resistance in series as gearless motors. It would be simply a question whether the rheostat had 20 ohms or 22 ohms. In other words, the rheostat would actually require a little more resistance in the case of high speed motors on account of these motors having a little less resistance than low speed ones. Any motor running at less than its *normal* speed, whether that be high or low, requires regulation which, probably, reduces its efficiency. But a motor can be designed to run at 200 revolutions almost as well as at a thousand. I agree with the remark of Mr. Steinmetz that the man who cannot design a motor of better than 35 per cent. efficiency had better not try to apply it to street car work. Any one can design a motor to run with better efficiency than that at any reasonable speed.

Prof. Dugald C. Jackson (Communicated): One side of the subject that is an eminently practical one to the street railway manager has not been touched by Mr. Parshall. In the smaller cities and towns, and in suburban places, it is possible to run street railway cars at a high rate of speed and with a considerable interval between them. These cars can be placed on wheels of large diameter (33 inches and 36 inches) without detriment to the traffic. The motors can, therefore, occupy considerable vertical space, armatures of large diameter can be used, and the magnets can have four poles. The development of this type of machine has apparently led to the controlling device described by Mr. Parshall. Such motors admit of placing a large number of turns of wire on the armature and of using each turn to its greatest advantage. In large cities quite different conditions exist. Speed is limited to a maximum not exceeding 10 to 15 miles per hour, and much of the traffic is carried for short distances; in other words, it is shopping or pleasure traffic. This demands cars on close headway and *easy of access*. The floors must not be raised far above the street level, and the motors must, therefore, take up little vertical space, hence requiring armatures of small diameter. This limits the number of turns of wire on the armature, makes the utility of four pole magnets doubtful, and requires the field turns to be increased. To do their work properly, such motors, when mounted on 26 inch wheels, should give satisfaction equal to that given by 15 horse-power or 20 horse-power motors of the latest types placed on 33 inch wheels. I think nearly all who have studied the matter will agree that the conditions here defined must be met in New York city and Chicago before the electric car can compete with the grip car. It is questionable whether it is not best to permanently connect the motor armatures in series with each other and with their fields for such work. The starting and speed regulation can be very satisfactorily effected by a rheostat, while it is possible to put the fields of the two motors in parallel for fastest speeds. Practically this method of connecting has been used with excellent success. It retains the principal advantages maintained for two motors on each car, *i. e.*, added traction and decreased chances of trouble due to lack of harmony between the motors, and introduces no unnecessary complications. While the magnetic and parasitic armature losses should be reduced with special care in street railway motors, at the same time the electrical resistances of armature and field should, with equal care, be made the least that is consistent with meeting other requirements. Reducing the energy used in the rheostat by increasing the loss in the fields is not likely to meet universal favor, as it merely transfers the seat of trouble to a point more expensive to repair. Hence, *rheostat* regulation, with or without auxiliary commutation of field, seems likely to prevail with the majority. With proper design, such as Mr. Parshall would give us, the auxiliary commutation of the fields may serve an excellent purpose in economizing weight of copper.

The General Electric Company.

The recent Cantor bill incorporating the General Electric Company read that the company should only be obliged to pay in one-twentieth of one per cent. tax on their capital, instead of the two per cent. exacted by the State, but that the tax should not be less than $10,000. On May 2 the company filed in the office of the Secretary of State a certificate of increase of capital to $50,000,000, and paid into the treasury $15,000 more, making up the total of one-twentieth of one per cent. on $50,000,000. The document is signed by Eugene Griffin, S. Dana Greene, Joseph B. Ord and James Jackson, a majority of the directors, and recites that the meeting at which the stock was increased was held in the Drexel building on the previous Saturday.

Electricity at the World's Fair.

THE ELECTRIC LIGHTING CONTRACTS—AN INTERESTING INTERVIEW WITH COMMISSIONER GARDINER C. SIMS.

Mr. Gardiner C. Sims, of Providence, one of the World's Fair Commissioners and chairman of the Committee on Electricity, was recently called upon by a representative of the ELECTRICAL REVIEW at the Armington & Sims Engine Company's office in Providence. In the course of a conversation on World's Fair matters, the following facts were developed:

"Mr. Sims, how many arc lights will be used at the Fair?"

"It is contemplated to use 5,000 arc lights at the World's Fair. Probably, from 800 to 1,000 of this number will be arranged on the grounds on posts for exterior lighting, and the remainder will be for general illumination of interior of main buildings."

"Between what companies will the contracts be distributed, and how many each, and at what prices?"

"The contracts already made are as follows: The Thomson-Houston Electric Company with their allied companies have a contract for 2,200 lights, the Exposition Company having an option to give them an order for 800 more, if the order be placed before August 1, 1892. The contract provides for the following distribution: Thomson-Houston Company, 1,000 lights; Fort Wayne Company, 300; Brush Company, 300; Schuyler Company, 300; Excelsior Company, 300. The division of the 800 I have mentioned is optional with the Thomson-Houston Company. Another contract has been made with the Standard Electric Company, of Chicago, for 1,000 lights without option of increase. Another contract has been made with the Western Electric Company, of Chicago, for 300 lights, with the option of increasing the order to 500, if ordered before August 1, 1892.

"These are the contracts made for arc lighting to date, and, as you will see, represent a total of 3,500 lights actually ordered, with an option of 1,300 more. The remaining 500 lights will probably be taken from foreign companies if they should be offered. The price paid is uniformly $20 per lamp, on the basis of the specifications for arc lights."

"How many incandescent lights will be used?"

"There will be used 93,000 incandescent lamps for the service plant. This, however, does not cover the interior lighting of machinery hall and annex, and the electricity building, which interiors have been reserved for an exhibit pure and simple of incandescent lighting."

"What companies supply them, and at what price?"

"At present I am unable to answer this question, as no contracts have been yet entered into."

"What is the extent of the electric power that will be installed; by what companies, and under what terms?"

"About 3,000 horse-power of electrical power will be employed. Contracts have been made with the Eddy Electric Manufacturing Company, of Windsor, Conn., for 1,000 horse-power capacity of generators at a rental price of $2.50 per horse-power. Another contract has been made with the Mather Electric Company, of Manchester, Conn., for 800 horse-power, at $2.50 per horse-power. A third contract has been made with the Short Electric Railway Company for 500 horse-power capacity of generators for the sum of $1. A fourth contract is now in preparation with the Westinghouse Electric and Manufacturing Company for 1,000 horse-power of generators for the sum of $1.

"These contracts provide for all the power generators needed in the service work, but I should state that no provision has yet been made for furnishing electric power in the electricity building, as we have not yet been notified of the requirements of that department. I should also mention that the reason for two companies being paid for the use of their apparatus, while the other two are furnishing apparatus free of cost, is on account of the fact that in reply to the original advertisement for generators prices were received ranging from free apparatus to apparatus at $15 per horse-power. The grounds and buildings committee decided to give the two lowest bidders $2.50 per horse-power, and decided that the rest of the power was to be furnished free of cost. There was no difficulty in securing apparatus on these terms, and, in fact, could easily arrange to-day for twice the capacity on the same basis if there was a place to put it."

"The steam plant; how is it arranged, where is it located, and by whom furnished?"

"The engines and generators are arranged along the south side of Machinery Hall, extending the entire length of the building, and occupy a width of about 110 feet, covering a space 800 by 110. The arrangement is such that the power generators will be grouped together, also the incandescent generators and the arc light generators. The engines have been furnished free, on the basis of the Exposition Company building the foundations, operating the machinery and returning the machinery to the owner. Nearly every firm in the country has contributed something towards this plant. As the electric power and lighting contracts have only just been closed (in fact, the incandescent lighting contract is not yet closed), we have only now been able to make definite plans of the arrangement of this machinery; and it will probably be three or four weeks before we can give an accurate description of the arrangement.

"The boiler plant is located in a building 85 feet wide by about 600 feet long, adjoining

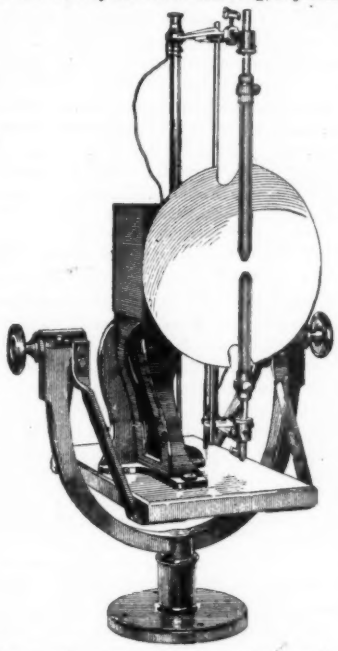


FIG. 1.—IMPROVED THOMSON-HOUSTON AUTOMATIC FOCUSING LAMP WITH VERTICAL CARBONS.

the south side of Machinery Hall. The contracts have been awarded for a plant guaranteed to evaporate continuously 450,000 pounds of water per hour from feed water at 212 degrees Fahr. to steam at 125 pounds pressure. The plant is practically 15,000 horse-power, on the basis of 30 pounds of water evaporated per horse-power per hour, and as most of our engines are compound and triple expansion condensing, the boiler plant is sufficient to give over 20,000 horse-power, as indicated in the cylinders of the engines.

"The total sum paid for this plant is $80,000, the work being distributed over six companies, each being paid the same amount per unit of evaporation capacity. The companies contributing towards this plant are as follows: Heine Safety Boiler Company, St. Louis, evaporation capacity of 112,000 pounds of water per hour. Campbell & Zell Company, Baltimore, evaporation capacity of 112,000 pounds of water per hour. Abendroth & Root Manufacturing Company, Philadelphia, evaporation capacity of 45,000 pounds of water per hour. Stearns Manufacturing Company, Erie, Pa., evaporation capacity of 45,000 pounds of water per hour. National Water Tube Boiler Company, of New Brunswick, N. J., evaporation capacity of 45,000 pounds of water per hour. Mills' Patent Sectional Boiler Company, Limited, Manchester, England, evaporation capacity of 90,000 pounds of water per hour."

"Who are the active men in the Department of Electricity, and what are the duties of each as commissioner, and the duties of the local officers in the premises?"

"The active men in the Department of Electricity of the National Commission are: J. P. Barrett, chief, and E. E. Keller, engineer. The active men in the Department of Construction are as follows: Frederick Sargent, electrical engineer; R. H. Pierce, assistant electrical engineer. Mr. Sargent is, without doubt, a very able mechanical and electrical engineer.

"The duties of the Department of Electricity of the Commission, as I understand it, are, to provide for an electrical exhibit in the Electricity Building; to lay out space in that building, and have all intercourse with exhibitors who are exhibitors in the strict sense of the word, and not primarily contractors for service plant and secondarily exhibitors. It is understood that, so far as the exhibit features of the service plant are concerned, such as testing and awarding of prizes, they come entirely under the charge of the Department of Electricity of the Commission.

"The duties of the officers of the Department of Electricity in the Bureau of Construction are to provide, maintain and operate a complete electrical service for the buildings and grounds of the Exposition, and to assist, so far as requested by the officers of the Commission, in carrying out such plans as they may wish carried out in connection with the electrical exhibits."

"How do you think the electrical exhibit will show up as a whole, and can you tell the number and names of the exhibitors?"

"I can only answer this question so far as it pertains to the service plant, which, of course, is incidentally an exhibit. Everything has been done which experience and thought can suggest to make a grand display of the service plant, and I believe it will surpass the expectations of the electrical people generally, as it has never been described, and very few people know of the extent of the arrangement of the electrical display we have in view in connection with the service plant.

"I should mention that all the details of the service work have been approved by the honorable committee on electricity of the local directory, Col. R. C. Clowry, chairman; and that they have repeatedly in discharge of their duties called for advice from many eminent electrical engineers, notably among whom might be mentioned the name of Mr. Luther Stieringer, of New York.

"As to the electrical exhibit proper, I am unable to make any statement regarding it, and I think it would be very much out of place for me to do so."

"When will the Electricity Building be completed?"

"The Electricity Building is expected to be completed in about six weeks."

"Please give any further facts of interest that occur to you."

"Under this question, I should like to draw your attention to the magnificence of the electrical display contemplated in and around the basin. Starting at a point about three feet above the water line, the sides of the basin will be outlined with a row of incandescent lamps about three feet apart. Next will be bordered with small incandescent lamps laid in the ground, the bulbs of the lamps just showing above the grass. There will be two electrical fountains. One is intended to be a large fountain with basin 150 feet in diameter, the modeling work of which is now being done by Mr. Mac Monies in Paris. The water in flowing from the 150 feet basin descends over a series of steps a distance of 10 feet to the waters of the basin proper. It is intended to illuminate the water, as it falls, from behind the falls, so that the different steps will be illuminated in different colors. The illumination of the fountain proper at night will be done with a search-light.

"The lines of architecture of the build-

FIG. 2.—FOCUSING LAMP, WITH CARBONS INCLINED.

ings fronting on the main court and basin will be outlined at night by rows of incandescent lamps. The Administration Building particularly will be outlined from top to bottom with incandescent lamps.

"On the east side of the harbor for pleasure craft and in line with the east and west axis of the main court and basin, there will be erected a tower about 300 feet high, on the top of which will be placed a 10 horse-power search-light, which has been kindly offered to us by Schuckert & Company, of Nuremberg. This light can, of course, be swung around in any direction, but will be used more particularly to throw colored rays on the statuary of the main fountain and on the Administration Building. At a point about 50 feet lower than the point by the search-light, we intend placing two other search-lights, one on the northwest corner of the tower, and the other on the southwest corner of the tower. These two search-lights are intended to throw rays obliquely on the sides of the buildings facing the basin.

"With the above equipment," said Mr. Sims, in conclusion, "we can, no doubt, have a very elaborate programme for an interesting electrical display at this point, which is, of course, the principal point of interest in the whole grounds."

Electric Search-Lights at the World's Fair.

One of the marvels of the recent electrical exposition at Frankfort was a six foot electric search-light of 20,000 candle-power. Schuckert, the Nuremberg electrician, astonished Europe in its construction. Schuckert is now at work on a larger light for the World's Fair. It will be seven and one-half feet, and of at least 25,000 candle power. The Frankfort light could be seen plainly at Bingen on the Rhine, 45 miles away. It is expected that the search-light at the World's Fair can be seen at least 60 miles away. Electrical Engineer Sargent is making plans for a tower 300 feet high, on which the big light will be mounted. At a height of 100 feet above the ground will be two six-foot search lights, and the three will suffice to illuminate the skies for miles around Jackson Park. Brilliant feats are accomplished with these search-lights. Sheets of light can be projected with parallel, converging or diverging rays. When the rays are thrown out parallel a clearly defined sheet of flame seems to be suspended in the darkness. By changing the reflector the rays are brought to a focus at long distances from the central station. These lights, turned on the buildings and alternately shot into the heavens or out across the lake, will produce brilliant electrical effects.

Automatic Focusing Lamps—Arranged for Use in the Art of Photography.

The Thomson-Houston Electric Company, of Boston, has designed and manufactured the lamps shown on this page to meet the requirements of the photographic art. They are believed to embody all features found by long experience to be necessary, and are used in many places and have given uniform satisfaction.

The lamps are of two styles: Fig. 1, with vertical carbons, for all ordinary work, and Fig. 2, with carbons inclined so as to utilize all the rays of light possible direct from the *crater*. No. 1 is so arranged as to be capable of being turned through wide ranges both vertically and laterally. No. 2 can also be arranged in this manner when desired.

Both carbons in these lamps are automatically fed, thus keeping the arc always in the focus of lens on reflector. The feeding mechanism is operated directly by the current. The arrangement is such that the lamps can be attached to any tripod in the same way that a camera is mounted, thus avoiding the use of a separate stand. A white reflector is furnished for ordinary work.

By the use of these lamps photographers are independent of sunlight. Printing and other processes can be accomplished at night or on dark and cloudy days, thus saving much time formerly lost.

The light is steady and uniform in intensity, so that, with a little experience, exposures can be made with a certainty of obtaining the desired results.

There are other uses to which these lamps are applicable, such as theatrical effects, stereopticons, etc., and when desired they can be arranged for any special work.

The lamp shown in Fig. 1 takes 30 amperes at 50 volts, and can, with a suitable rheostat, be used on any direct current circuit. Two lamps, with proper rheostat, can be run in series on a 110 volt circuit. A special lamp can also be furnished to run on arc circuits. The lamp, Fig. 2, takes 20 amperes at 50 volts, and is to be used with a suitable rheostat on direct current incandescent circuits only.

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In an interview with World's Fair Commissioner Gardiner C. Sims, published in this issue of the ELECTRICAL REVIEW, will be found some interesting facts regarding the part electricity will play at the great Fair. Information is also adduced showing the disposition of some of the lighting contracts recently closed.

The electric lighting effects displayed at the recent Actors' Fund Fair in New York city were far and away the best exhibition of what can be done with the electric light in decorative art that has yet been attempted. The unique feature of this display was that small units of light were used exclusively, the great majority of the lamps being of one candle-power, and the rest being five, eight and ten candle-power each. With such small units everything depends upon proper distribution of the lights. The gentlemen who carried out this scheme may rest assured that they have opened wide the eyes of the public and of many electricians as to the possibilities of the incandescent lamp.

We learn that M. Faure has recently invented a process of producing aluminium, by means of which he hopes to reduce its price to about 16 or 18 cents a pound. Briefly speaking, his proposed method consists in obtaining in a cheap manner aluminium chloride and decomposing it electrically. This decomposition can be effected with a smaller potential difference than can the fluoride now most frequently used for preparing aluminium by electrolysis, and at the same time a valuable bye-product is formed in the chlorine liberated. It is said, however, that there are considerable difficulties in the way of making the proposed process a commercial success, which it is feared may prove insurmountable.

ELECTRIC HEATING.

In a recent lecture at the Royal Institution on "Electric Motors, Meters and Money Matters," Professor Ayrton referred to the question of heating by electricity, stating that at first sight it would seem that it could not possibly be economical to use the current for heating purposes, as the amount of energy contained in a Board of Trade unit costing 7*d.* or 8*d.* could be obtained by burning about ¼*d.* worth of coal. On the other hand, however, the electrically generated heat could be applied just where it was wanted with a minimum of waste. Experiments made by his students and those of Professor Perry showed that it cost about 2*d.* an hour to maintain an ordinary flat iron at the proper temperature by a zigzag of insulated wire embedded in it. A frying-pan constructed on the same principle was raised to a temperature sufficient to frizzle butter by an expenditure of 6.84 watt hours, which, at 7*d.* per Board of Trade unit, would cost about ¼*d.* An omelette could be made in this frying-pan in about 1½ minutes at about the same cost.

THE EDISON TELEPHONE PATENTS.

The air has been full of rumors for several weeks that the Patent Office was about to issue a patent or patents based on an invention of Thomas A. Edison, which would give a new lease of life for 17 years to the great bugbear of a few lay journals, the telephone "monopoly." Three patents were issued on May 3, No. 474,230, No. 474,231 and No. 474,232, to the Western Union Telegraph Company, as assignees of Thomas A. Edison, which are doubtless the subject of these tribulations. The last two patents, which we publish in full on another page, are based upon the same apparatus and contain, respectively, the following claims, the application upon which one is based having been a division of the application upon which the other is based, a step probably deemed expedient by reason of proceedings in the Patent Office:

"In a telegraphic apparatus operated by sound, the combination, with the diaphragm, of one or more contact points of plumbago, or similar inferior conductor in the electric circuit, whereby the rise and fall of electric tension is proportionate to the pressure exerted upon the said point or points by the diaphragm, substantially as set forth."

"A spring forming or carrying one electrode of the circuit of a telephone and constantly pressing against the other electrode and diaphragm to maintain the required initial pressure between the electrodes, and yield to the movement of the diaphragm, substantially as described."

The original application was filed July 20, 1877, which explains the broad scope of the claims. The claims seem to cover every known form of carbon transmitter, but we fail to see how these patents can play any importance in the art of telephony, unless the Supreme Court be expected to legislate out of existence Statute 4887. Upon the face of the patents is the following endorsement: "Patented in England July 30, 1877, No. 2,909; in Canada, October 20, 1877, No. 8,026; in France, December 19, 1877, No. 121,687; in Belgium, January 11, 1878, No. 43,984; in Austria-Hungary, January 15, 1878; in Italy, January 19, 1878, No. 9,791; in Germany, January 23, 1878, No. 14,308; in Spain, May 6, 1878, and in Russia, February 15-27, 1882, No. 1,161."

Under the section of the law above quoted, every patent granted for an invention which has been previously patented in a foreign country is limited to expire at the same time with the foreign patent, or if there be more than one, at the same time with the one having the shorter term. The length of the term of the Canadian patent is perhaps involved in some doubt, as this same question is involved in the incandescent lamp patent now before the United States Court of Appeals. But assuming that the British patent, among those recited, is the one having the shortest term, protection on the present invention would, under the above quoted statute, be 14 years from July 30, 1877; to wit: July 30, 1891. These two patents, therefore, present the anomalous condition of having expired, as an Irishman might say, before they were granted.

ORGANIZATION OF THE GENERAL ELECTRIC COMPANY.

The General Electric Company, which includes the Thomson-Houston Electric Company, of Boston, and the Edison General Electric Company, of New York, has received its charter under the laws of the State of New York and will be known hereafter as the General Electric Company.

At a meeting of the interested parties held in New York, Wednesday afternoon of last week, the following board of directors was elected with Mr. H. McK. Twombly as chairman: T. Jefferson Coolidge, C. A. Coffin, Eugene Griffin, F. L. Ames, H. L. Higginson, of Boston; H. McK. Twombly, J. Pierpont Morgan, Thomas A. Edison, F. S. Hastings, D. O. Mills and C. H. Coster, of New York.

The officers of the company were elected as follows:

President, Chas. A. Coffin, Boston, Mass.; first vice-president, Eugene Griffin, Boston, Mass.; second vice-president, Samuel Insull, New York; treasurer, A. S. Beves, New York; first assistant-treasurer, Gen. B. F. Peach, Jr., Boston, Mass.; second assistant-treasurer, W. F. Pope, Boston, Mass.; secretary, E. I. Garfield, Boston, Mass.; assistant-secretary, A. S. Beves, New York; comptroller, Jas. P. Ord, New York; auditor, Edward Clark, New York.

This is one of the strongest organizations, financially speaking, in the United States to-day. It is estimated that the board of trustees represent a personal financial strength of upwards of $200,000,000.

The ELECTRICAL REVIEW, in its issue of March 12, published the following editorial note relating to the presidency of the General Electric Company:

"The man fitted by ability, integrity and experience for the presidency of the consolidated Edison and Thomson-Houston interests is Chas. A. Coffin, of Boston. If he is willing to accept, the appointment should be made, and would carry with it a confidence that no new and unfamiliar name could possibly possess."

The board of trustees evidently took the same view. We expect to see Mr. Coffin wield the vast power now placed in his hands, not only for the advancement and success of the General Electric Company, but also with a realizing sense of the importance of electrical development as a whole.

With Mr. Garfield as the capable, far-seeing secretary, and with the other experienced executive and technical members of the staff of this great organization, and with the immense business already secured, its firm establishment and rapid growth would seem to be undoubtedly assured. The REVIEW expects to see invention encouraged and fostered, and electrical development in all branches favored and sustained by the General Electric Company as now officered—a line of policy not always followed by corporations of great wealth and vast influence.

The abstract of the bill incorporating the General Electric Company, which we publish in another column, shows that at last the State of New York is awakening to the fact that if enterprising financial institutions are to be kept within the borders of the State a more liberal policy must be inaugurated. The success in this instance of the General Electric Company, through the efforts of its able attorney, is one that we are confident will be of inestimable value to the future of the State, and is of particular importance as establishing a precedent that will encourage future corporations. Electricity is not only symbolical of progress in the scientific and industrial field, but in this case has been the means of accomplishing a great deal in financial and legislative circles.

The ELECTRICAL REVIEW is indebted to the Wagner Palace Car Company for three large photographs of the interiors of the beautiful palace cars used on the trip of the delegates of the International League of Press Clubs to San Francisco and return, last January. The handsome and elegant finish of these interiors is specially noticeable, and to every one who participated in that great trans-continental tour these photographs will be a very pleasant memento.

CORRESPONDENCE.

OUR LONDON LETTER.

The Decennial Number.—I must begin my letter by thanking you for your beautiful Decennial Number, which I received last Tuesday. Many to whom I have submitted it agree with me that it combines the highest degree of excellence in selection, expression and illustration. The number and variety of the advertisements also, and the attractive form in which they are presented, cannot fail to induce all intending advertisers, whether inventors, manufacturers or vendors of others' works, to avail themselves of the singular advantages which, it is evident, you can so liberally afford. We cordially wish you every success.

Select Committee of Parliament.—The following gentlemen, members of parliament, have been appointed to serve on the Select Joint Committee of the Lords and Commons, whose business it is to prepare electrical and cable railway bills for legislative consideration: Messrs. Stansfeld, Whitmore, Gathorne-Hardy, Bolton and Storey-Maskelyne.

The Electrical Exhibition at the Crystal Palace, Sydenham.—Favored by the most delightful weather, the Electrical Exhibition at the Crystal Palace continues to attract numerous visitors. In many of its parts, however, it cannot be fully appreciated by the general unscientific crowd, who do not know either the nature of the exhibits or the uses to which they are applied. To remedy this defect a successful attempt is made by Dr. J. A. Fleming, M. A., of University College, who is delivering, in the rooms of Messrs. Laing, Wharton and Down, a course of lectures, illustrated with experiments, on the wonderful phenomena of electro-magnetism. Every moment he affords some new surprise. The popular idea of the gravity of matter seems here to be completely overthrown. When we see a heavy copper ring, untouched by any hand, fly up into the air, and remain there suspended, or flutter around the hall like a butterfly; our innocent legerdemain tricks at the Egyptian Hall, Piccadilly, or even the travellers' tales about the jugglings of Indian fakirs, are here left far behind; to use the phraseology of the race course, "they are nowhere."

The House to House Electric Light Supply Company.—This company has just issued a report which is a remarkable record of steady progress. In a splendid factory which they built for themselves at Lillie Bridge, West Brompton, they began business in the early days of 1890. At the close of that year they had about 250 houses connected, with a revenue of £5,000. They began the current year with nearly 400 houses, and a revenue of £8,500. Doubtless, this success is due in no small degree to the fact that ground in immediate proximity with the company's premises is, every successive Summer, the site of an exhibition. Yet it is strange that the syndicate of the forthcoming Horticultural Exhibition, to be held on this very ground, has contracted for the supply of electric light plant and accessories with the Brush Electrical Engineering Company.

The General Electric Power and Traction Company.—With sincere regret we learn that, owing to temporary embarrassments, the works of this company have been closed by order of the Board. The business will, however, be taken over by the Electric Construction Corporation.

Extension of the Use of Electricity.—As the advantages of electric appliances in their multifarious forms become more widely known the general demand for them increases and is only limited by the difficulty of meeting the very heavy initial expenses. Wherever money enough can be found, electricity is making its way, not only through the busy thoroughfares of our metropolis, or our great commercial centers, but also through our smaller provincial towns in every part of the three kingdoms. In Ireland alone we find, within the last few days, the populations of Londonderry, Kilkenny and Galway, calling upon their civic authorities to provide their streets with the electric light. An additional impetus was given recently by the declaration of one of the surgical staff of the Royal Ophthalmic Hospital, in Dublin, that the electric light is the best light for eyes that are weak or affected with disease, occasioning them less discomfort and injury than that produced from gas, oil or candles. This fact has been also recognized here. The Royal South London Ophthalmic Hospital, which is undergoing extensive structural enlargement and improvements, is being fitted up throughout with electric light by Messrs. Walter Andreae & Company, of 47a Lower Belgravia street, Belgravia, W.

Royal Electric Committee for the Chicago Exhibition.—The electric committee appointed by the Royal Commission for the Chicago Exhibition met on the 28th ult., Mr. W. H. Preece in the chair. The other members present were: Sir Fred. Abel, Professor Adams, Major-Gen. E. R. Festing, Professors Forbes, Hughes and Perry, Major Gen. E. E. Webber, Sir H. Wood and Messrs. Siemens, Spagnoletti, Willans and Wimshurst. The chairman stated that every department of the electric industry of this country would be adequately represented, and that arrangements were made for showing a series of rooms furnished in English style and fitted with the most recent applications of electric light. FFRENCH.

London, April 30.

OUR SAN FRANCISCO LETTER.

Nearly 300 men are employed on the Telegraph Avenue electric road now building in Oakland.

The New Science Building at the University of California, in Berkeley, is to contain electrical apparatus valued at $25,000.

The Thomson-Houston Company has recently installed a 500 light incandescent plant at the Piedmont Baths in Oakland, and a 150 light plant for the National Brewery, this city.

The Telephone Building on Bush street is now partially occupied by the telephone company, but considerable work remains yet to be done before the company will be fully settled in their new and commodious quarters. The company has at present about 4,500 subscribers.

The Incandescent Light Plant recently put into operation at Ukiah, Cal., is giving great satisfaction. It was installed by the Edison Company, and the equipment consists of two 15 kilowatt dynamos of 125 voltage each and a 50 horse-power engine with a 75 horse-power boiler. The street lighting is furnished by 24 thirty-two candle-power lamps.

The Latest Rumor current in railroad circles regarding the action of the Southern Pacific Railroad Company is that it intends to discontinue running the local broad gauge trains to Alameda, the intention being to substitute an electric road from First street, Oakland, the terminus of the Telegraph avenue electric road, over the Alice street bridge to Alameda. In making this move the company hope to do away with the deadhead travel within the city limits of Alameda.

The Electrical Engineering Company, this city, has recently equipped for the Taylor Mining Company, Eldorado County, this State, a 25 horse-power pumping plant, power being furnished by the Pelton water wheels. A separate dynamo furnishes power for two drills. A 100 light incandescent dynamo has also been installed, which is to furnish light for the mills, lodging houses, underdrifts, etc. This company furnished the *Examiner* building with the plant mentioned in a previous letter.

Havoc Was Played with electric light and telegraph wires by the recent heavy earthquake in Vacaville and Woodland. The damage was caused mainly by walls falling upon the wires. A telegraph operator in Dixon, near Vacaville, started to send a message, but how far he got with it is explained below. It read as follows: "At about 9.45 this morning we had an awful earthquake. Buildings swayed and the crashing of brick and the noise was" - - - - (At this juncture the operator said: "I can't stay here any longer as this building is liable to fall at any minute.") In this city the shock was light and no damage resulted.

Dr. Thomas Addison, general agent in this State for the Thomson-Houston Electric Company, reports that he is now equipping the following roads throughout the State: San Francisco, San Mateo and Metropolitan, San Francisco; the Oakland, Haywards and San Leandro, the Southern Pacific's Telegraph avenue line, and the branch line of the Consolidated Piedmont Company, Oakland; the Stockton Electric Railway, Stockton; the Santa Cruz, Garfield Park and Capitola, Santa Cruz; the roads of the San Diego Electric Railway Company, San Diego; the Sacramento Central Railway Company's roads, Sacramento. The company are to equip several other roads, work upon which has not commenced. It is obvious that California is doing her share as far as the building of electric roads is concerned, and also that the Thomson-Houston Company is doing its share of the equipping.

A Lineman Named Henkel recently lost his life in Los Angeles by coming in contact with a live wire belonging to the Los Angeles Electric Company. Numerous press reports were heralded throughout the State, but, as usual, these were devoid of the real facts of the case. With the idea of obtaining an authentic account, your correspondent addressed a letter to the company, in reply to which the following facts were received:

Every employé is given a copy of the rules and is required to sign for same. The following are extracts from the rules:

"When working on line circuits, or poles carrying line circuit wires, work must be finished and men off the poles fully five minutes before starting up time. If the work is urgent, telephone to the works to wait until you telephone 'all clear.'

"The company's whistle blows five minutes before starting up time; when it is heard men must at once get off the poles."

The men had just finished gathering up their tools and clearing up, preparatory to returning to the works, when, about 10 or 15 minutes after the sounding of the whistle, one of the workmen noticed Henkel up the pole and amongst the wires. Upon investigation he was found to be perfectly rigid, death, no doubt, having been instantaneous. Why he had gone up the pole the company is unable to state, as everything seemed right. At the works the machine showed the circuit to be all right. The case of Henkel can be compared to that of a man who deliberately steps in front of a locomotive after the whistle has sounded a warning.

San Francisco, April 30. J. R. K.

OUR BOSTON LETTER.

Mr. P. A. Dowd, of this city, until recently the New England agent of the Wenstrom Dynamo and Motor Company, is busily engaged at present in promoting a new project for furnishing power.

Mr. E. H. Kitfield, civil and electrical engineer, No. 930 Exchange building, this city, is preparing plans for the new electric light station to be built at Braintree, Mass. Mr. Kitfield has been appointed consulting engineer for the town named.

The Van Choate Electric Car and Light Company has been organized at Portland for the purpose of manufacturing and dealing in electrical appliances and machinery. E. H. Kimball of Chelsea is president and E. H. Hill of Brookline, Mass., treasurer.

Mr. Willard H. Gilman, of this city, claims to have perfected an electric automatic musical instrument and an improved electric boot-blacking device, which he will have on exhibition next week at his office, No. 8 Marlboro' building, 403 Washington street, this city.

Mechanics' Hall to have an Electric Light Plant.—At the quarterly meeting of the Mechanics' Hall officials, recently, it was decided to contract for an isolated electric light plant to be installed in the basement of the building and which must be in position and in working order by October 1.

The Norway (Maine) Electric Light and Power Company was incorporated recently. All the money required to purchase and control water power privileges affording over 600 horse-power, and to defray cost of building the station and the necessary lighting and power equipment, has been subscribed.

The Shipman Engine Company, this city, has been very busy for some time filling orders for power equipment for small isolated electric light plants and steam launches. Manager Frank Proctor reports having received recently numerous testimonials regarding satisfaction afforded by the Shipman engine.

Messrs. M. K. Kendall & Company, contractors for electrical construction work, both for electric railway and lighting, and dealers in electrical supplies, have established their headquarters at No. 8 Oliver street, this city. Mr. Kendall was formerly the senior member of the well known firm of Messrs. Kendall & Slade, this city.

Albert and J. M. Anderson, this city, the widely known manufacturers of electric railway supplies, have issued a new catalogue. The pamphlet is profusely illustrated with cuts of "Aetna" insulated line material for overhead electric railway construction for which the Messrs. Anderson have already acquired an enviable reputation.

Projected Electric Railway.—The Boston daily *Globe* of April 29 states: "Massachusetts and New Hampshire capitalists are considering building a standard gauge electric road from Epsom, on the Suncook Valley line, to East Northwood—about 11 miles. Estimated cost, $100,000. When completed, the road may be leased to Concord & Montreal, and may finally be extended 13 miles further to Barrington on the Rochester division of the Boston & Maine."

The Southern New England Telephone Company is spending a large amount of money upon new metallic circuits. During the past year and a half the company has strung over 6,000 miles of copper wire. This does not include the wire in the underground systems of New Haven, Hartford and Bridgeport, or the submarine and aerial cables throughout its territory. It is estimated that in order to bring the plant into a high state of efficiency, the work on which is still progressing, there has been an outlay of $750,000.

The Iona Electric Manufacturing Company is the name of a new organization having its headquarters in this city. The officers of the company are: Mr. Norman Marshall, president; Mr. H. P. Stanwood, treasurer, and Mr. H. M. Nicholls, secretary. The above named gentlemen, with Messrs. S. L. Whipple and Mr. John C. Holman, are the directors. The company will manufacture electrical supplies of various kinds and a line of electric specialties. The Redding Electric Company, also of this city, will act as sole selling agents. W. I. B.

Boston, May 7.

OUR CHICAGO LETTER.

D. B. Dean, eastern representative of the McGuire Manufacturing Company, spent three days in the city this week.

The Rockford Electric Manufacturing Company, Rockford, Ill., has placed, in addition to the lighting plant, one 10 horse-power motor for laundry work in the Chicago Oyster House.

C. M. Howell, president of the Illinois Electric Lamp Company, spent several days at the company's office in this city this week. Mr. Howell is prosecuting attorney for Gogebic County, Mich.

George Cutter is getting out some experimental work to be used in illustrating his lecture which will be given before the State of Illinois University next week. He also wears a happy smile on account of having secured the contract for wiring the new Republic House, in Milwaukee, Wis., with Simplex wire.

The Meeting of the Chicago Electrical Association, held Tuesday night, was brought to a sudden close. Mr. F. R. McButy was partially through reading his paper, "Sparking and Flashing in Dynamos," when it was discovered that the building was on fire, and those in attendance rushed madly to the street. The building was damaged considerably, but fortunately no one was injured.

The Central Electric Company have just received the second car load of carbons from the Washington Carbon Company, for which they are Western agents, and now have in stock 400,000 carbons of various sizes, which places them in a position to fill all orders with promptness, which will certainly be appreciated by the trade. They are also having a good call for M. C. K. wire, which is manufactured by the Okonite Company.

R. J. Randolph, who has lately put the "Daisy Fan Motor" upon the market reports many sales recently, and the "Fan" is giving the very best satisfaction. Mr. Randolph has received the Western agency for the Duplex Electric Company, Corry, Pa., and has this week placed two 2 horse-power and three 10 horse-power motors in the city. After May 1 Mr. Randolph will occupy office 1325 "Monadnock," where he will be pleased to see all his old friends.

The Annual Meeting of the Chicago Electric Club was held at the old rooms on Adams street, on April 21. The polls were kept open from 4 to 6 P. M., but as there was no contest the vote was light. The following named gentlemen were elected for the ensuing year: President, B. E. Sunny; first vice president, F. B. Badt; second vice-president, Alex. Kempt; third vice-president, M. A. Knapp; fourth vice-president, W. B. Pearson; secretary, W. A. Kreidler; treasurer, F. S. Terry; managers, F. W. Parker, chairman, Geo. C. Bailey, E. Baggott, J. P. Barrett, W. J. Buckley, F. W. Cushing, F. E. Degenhardt, E. R. Gilman, J. J. Nate, C. H. Wilmerding; membership committee, C. C. Haskins, chairman, T. G. Grier, Geo. Cutter. The old quarters on Adams street, which have been occupied during the last two years, will be deserted on May 1, when the club will take possession of its new rooms on the northeast corner of Clark and Monroe streets. M. J. B.

Chicago, May 7.

PERSONAL.

Mr. F. P. Little, of Buffalo, N. Y., was a metropolitan visitor last week.

Mr. J. E. Talbot, of the Fort Wayne Electric Company, Fort Wayne, Ind., was in New York last week.

President C. E. Dustin, of the Schuyler Electric Company, Middletown, Conn., visited New York last week.

Mr. M. M. M. Slattery is at Hot Springs, Ark. He telegraphs that a rumor of his illness is without foundation.

Prof. Alexander Graham Bell and Mr. Gardiner Hubbard, of Washington, D. C., were at the Gilsey House last week.

Mr. S. G. Booker, manager of the Fidelity Carbon Manufacturing Company, St. Louis, spent a few days in New York last week.

Col. L. W. Burnham, president of the Electric Gas Lighting Company, Boston, visited New York and Philadelphia last week.

Mr. William Stanley, Jr., of Pittsfield, Mass., has been elected a foreign member of the British Institution of Electrical Engineers.

Mr. Geo. H. Roe, of San Francisco, did about two months' business in six days in New York last week, and then took the Pennsylvania Limited for the Pacific coast.

Mr. Arthur L. Bosley has resigned from the presidency and general managership of the Pennsylvania Electric Engineering Company, of Philadelphia. Mr. Bosley's address for the present will be Towson, Md.

Dr. F. A. C. Perrine, who for several years past has been chief electrician for the John A. Roebling's Sons Company, Trenton, N. J., has resigned and accepted a position with the Germania Electric Company, of Boston. The latter company is to be congratulated upon this valuable addition to its staff.

Telephonic News

*** Over 500 telephones were rendered useless at Pittsburgh last week during an electric storm.

*** It is the intention of the Central Union Telephone Company to construct in the near future a metallic circuit toll line from Columbus to Toledo, Ohio.

*** The New York and New Jersey Telephone Company has taken possession of its handsome new building at Erie and Bay streets, Jersey City, N. J.

*** The business men of Lake Geneva, Wis., have received a proposition from the Wisconsin Telephone Company to erect a telephone line from Twin Lakes to Lake Geneva.

*** The Detroit Telephone and Telegraph Construction Company having outgrown their limited quarters in the Newberry block, will move into the new and elegant telephone exchange building, at the northwest corner of Washington avenue and Clifford street, in about two months.

*** The Erie Telephone and Telegraph Company has leased the third floor of the Kennedy building, at Houston, Tex., for a period of 10 years, and will occupy it as an exchange. For a number of years the telephone exchange has been in the tower of the Market house, and the telephone system has been used as a method of giving alarms of fire.

*** The Metropolitan Telephone and Telegraph Company last week re-elected these directors: Leonard F. Beckwith, Charles F. Cutler, Joseph P. Davis, Thomas T. Eckert, William H. Forbes, George J. Gould, Norvin Green, Edward J. Hall, Jr., John E. Hudson, John Jameson, Charles A. Tinker, John Van Horne and William H. Woolverton. Mr. Van Horne presided at the meeting, and John H. Cahill was secretary.

*** In accordance with the recent decision of the United States Circuit Court of Appeals of Philadelphia, in the case of the Postal Telegraph Company *vs.* the Delaware and Atlantic Telegraph and Telephone Company, a peremptory mandate to the latter to place a telephone in the Postal Company's office at Philadelphia, was issued last week and served upon Superintendent Mehaffy, of the telephone company. Mr. Mehaffy said that the mandamus would be complied with.

*** The Southern New England Telephone Company is spending a large amount of money upon new metallic circuits. During the past year and a half, the company has strung over 6,000 miles of copper wire. This does not include the wire in the underground systems of New Haven, Hartford and Bridgeport, or the submarine and aerial cables throughout its territory. It is estimated that in order to bring the plant into a high state of efficiency, the work on which is still progressing, there has been an outlay of $750,000.

*** A meeting of the board of directors of the Hudson River Telephone Company was held last week. The meeting was called to elect officers to fill the vacancies caused by the death of Manager Andrew B. Uline. James H. Manning was elected vice-president and Selden E. Marvin a director. The position of general manager was not filled. Mr. H. E. Hawley is acting manager and President Joseph B. Davis, of New York, is in Albany giving attention to the affairs of the company. About $22,000 of cable was ordered purchased. A meeting of the Union Telegraph and Telephone Company was held subsequently to the Hudson River Telephone Company's meeting. Mr. C. J. French, of Boston, was elected a director in place of the late Andrew B. Uline, and Mr. H. E. Hawley was appointed to act as general manager of the company.

Edison Carbon Telephone Patents.

THE CLAIMS AND SPECIFICATIONS OF THE PATENTS WHICH WERE ISSUED LAST WEEK, PRESENTED IN FULL.

We present herewith the drawings of three patents issued to the Western Union Telegraph Company, as assignees of Thomas A. Edison for "Speaking Telegraph" patents. These patents were issued May 3, 1892, and are numbered 474,230, 474,231 and 474,232. The first cut, containing two figures, represents the drawings of patent No. 474,230, of which the following is the specification:

Telegraphs have been made to operate by sound and the movement of a diaphragm has been employed to open and close an electric circuit. In cases where reeds or bodies following the law of the pendulum have been made use of the same respond to changes of tone and produce musical sounds. In telegraphs that are intended for transmitting spoken words there is a difficulty arising from those words generally being uttered in one key or tone, or nearly so, and hence they are not distinct and clear.

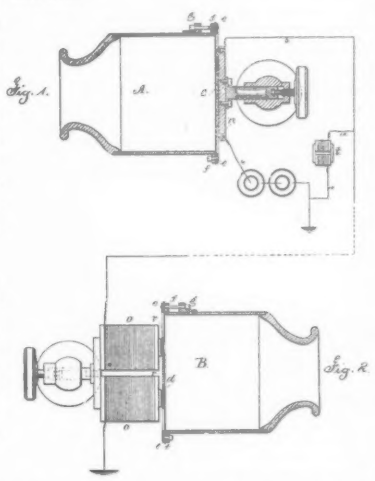


FIG. 1.—EDISON CARBON TELEPHONE PATENTS.—DIAGRAM OF PATENT NO. 474,230.

This present invention I designate as a "telespecan" or "speaking telegraph," because it is adapted to transmit spoken words regardless of the musical key.

In the drawings, Fig. 1 is a section of the transmitting instrument; and Fig. 2 is a similar view of the receiving instrument, the wire connections between the two serving to illustrate the telegraph line and electric circuits.

The resonators or sounding tubes or boxes A B are of any desired size, shape or material. The box A is the one into which the words are uttered, and the box B or resonator is the responding part to which the attendant listens. The diaphragms *c d* are applied at the side or end of the respective boxes, and these should be provided with clamping rings *e f* and tightening screws *g*, somewhat on the plan of a kettle-drum, so that the diaphragms may be of the proper tension. I prefer and generally use sheet metal for these diaphragms, which may be of a suitable thickness, say, one-eighth of an inch, more or less, according to the size of the instrument. In front of the diaphragm *c* of the transmitter I make use of a second plate or a disk *n*, of suitable material, having a conducting surface. I have found that a disk of hard rubber coated with plumbago answers well; but a disk of some conducting metal or substance may be employed, or a plate of metal coated with some semi-conducting substance may be used. The circuit wires three and four from the line and a battery or other source of electricity are connected to this apparatus, either at opposite sides of the disk *n*, or one wire may be connected to said disk *n* and the other to the diaphragm *c*.

At the receiving instrument there is an electromagnet *o*, with its poles facing the diaphragm *d*, and the armature *r* is fastened to said diaphragm, or the diaphragm itself may form the armature if made of soft iron. The disk or plate is accurately adjusted to the proper proximity to the surface of the diaphragm, so that in a state of rest there will be little or no current passing from the battery upon the line; but the vibrations that are received by the diaphragm *c* from the voice cause the electric energy on the line to increase and decrease, according to the intimacy of contact between the vibrating diaphragm and the surface of the adjacent disk, for if the electric conductors are connected to the diaphragm and disk, respectively, the current that passes will be pulsated and raised or lowered by the intimacy of contact of the surfaces or by the variable resistance where the conductors are in contact with a surface of plumbago or other poor conductor of electricity, the current being increased by the diaphragm affording less resistance than the plumbago, when the vibration of the diaphragm brings the surfaces into contact to a greater or less extent. In all instances the diaphragm coming into contact with the disk to a greater or less extent, according to the amplitude of its vibration, lessens or increases the distance that the electric current is obliged to travel over the surface of the disk of plumbago or similar inferior conducting material, and consequently the resistance in the line and rise and fall of electric tension.

By this phonetic or speaking telegraph the diaphragm at the receiving station will be influenced by the action of the electro-magnet in the same proportion as the rise and fall of electric energy produced by the vibrations of the voice, regardless of the musical key, and the utterances at one end are reproduced at the other with great clearness and accuracy.

The electro-magnet or helix *t*, introduced in the branch 10 between the main line and the earth, is adjusted by a rheostat or otherwise to neutralize the static charge and discharge in the line as heretofore employed by me in chemical and other telegraphs, and hence any false vibrations from the effect of static charge or discharge are prevented.

The static resistance to a pulsation is lessened by the action of the electro-magnet helix, because in practice the electro-magnet in the circuit aids the pulsation, so that it becomes more distinct at the receiving station, and when the pulsation ceases upon the line there is a static discharge that is met and neutralized by the discharge of the electromagnet, so that there is no prolongation of the pulsation. This is of great importance in speaking telegraphs in making the sounds clear and distinct instead of the tones running into each other.

I am aware that in kettle-drums and banjos the diaphragm is provided with screws for tightening the same.

I do not claim in my present instrument the combination, with the diaphragm, of a ring or frame, and screws for adjusting the parts.

I claim as my invention:

1. In a speaking telegraph transmitter, the combination of a metallic diaphragm and disk of plumbago or equivalent material, the contiguous faces of said disk and diaphragm being in contact, substantially as described.

2. As a means for effecting a varying surface contact in the circuit of a speaking telegraph transmitter, the combination of two electrodes, one of plumbago or similar material, and both having broad surfaces in vibratory contact with each other, substantially as described.

The second cut illustrates the drawings of patents Nos. 474,231 and 474,232. These patents were both based upon the same original case, the second one being a division of the first. The following is the specification of patent No. 474,231:

The object of this invention is to transmit the human voice over telegraphic wires for conversational purposes.

The invention consists in the use in the circuit of a speaking telegraph transmitter of one or more contact points, formed of semi-conductors, such as plumbago, per-oxide of lead and other oxides and conducting material.

Fig. 1 shows the transmitter and receiver. A is the resonant chamber, over the end of which the diaphragm is stretched, either side of which may be made heavier in the center by a small weight if great amplitude is required of the diaphragm. *b c* are the two contact springs, having points made of compressed plumbago, mixed, preferably, with gum-rubber; but any substance not liable to rapid decomposition may be used. These points face each other on the opposite side of the diaphragm and make contact with platina disks secured to the diaphragm. The spring *b* passes through a hole or small slot in the side of the transmitter. 2 and 3 are the main batteries. The battery 2 has zinc to the line or point *c* and the battery 3 has copper to the line or spring *b*. When the springs *c* and *b* are adjusted so as to make contact with the diaphragm equally, no current passes to the line; but when the diaphragm is vibrated, its movement to one side —say, *c*— causes a greater pressure upon the plumbago on that spring and a lessening of the pressure on the plumbago on *b*. Hence the balance of the batteries 2 and 3 will be destroyed. 2 being given the advantage will send a negative current to line. Upon the return of the diaphragm, the battery currents will again neutralize each other. The vibration of the diaphragm to the other side causes the pressure to be reversed and the battery 3 will send a positive current to the line. As plumbago decreases and increases its resistance enormously under slight changes of pressure, it follows that the strength of the electric waves will be in proportion as the speaker's voice is strong or weak.

In Fig. 2 is shown the contact spring, which I prefer to use instead of *c* and *b*, which are used merely to assist in explaining the operations more clearly. 5 is a U-shaped spring secured to the screw 8, which is adjusted back and forward by the thumbnut 9. 7 is the pillar holding such screws. *r* is a piece of soft rubber or equivalent substance placed between the prongs of the spring 5. 6 is a wire, or band, which serves to bind the prongs tightly against the rubber *r*, so as to prevent the prongs acting as a tuning-fork and transmitting harmonic vibrations not desirable. 10 is the plumbago contact point. The object of the U-spring and rubber is to present a semi-rigid point for contact, so as to prevent a rebound and allow of a slight yield when the plumbago is pressed by the diaphragm. D is the receiver, which consists of a resonant chamber of any suitable character, either a tube, as in Fig. 3, or a box, as at D, Fig. 1. *f* is a rigid arm secured to the box and is provided upon its extreme end with an adjusting screw *h*. Near the end of the arm is secured a spring *g*, whose end rests upon the chemically prepared paper upon the drum *e*. The under side resting upon the paper is platinized. The screw *h* serves to increase and decrease the pressure of the platina spring upon the paper. When the paper is moved slowly by rotating the drum *e*, the waves of electricity coming over the line pass through the arm *f* to the platinized spring *g*, thence through the paper to the earth. If a negative current passes in the opposite direction, nearly all friction between the platina plate and the paper ceases and the resonant box or diaphragm regains its normal position. When the positive current passes through the same channel, the normal friction of the paper is augmented and the chemical surface, acting upon the platina, serves to give a movement to the resonant box. Thus the mechanical force applied to move the chemical surface acts with the electric current to produce the vibration of the resonant chamber. The principle of this method of obtaining motion by electro-chemical decomposition is described in my letters patent No. 158,787, granted January 19, 1875. To facilitate the discharge of electricity from the receiving apparatus, it may be shunted with an electro-magnet.

Fig. 4 shows the devices which may be employed to rotate the drum *e* in a noiseless manner, so as to prevent interference with the weak, hissing consonants which form a part of ordinary conversation. *p* is a worm, and *o* the wheel for revolving the roller *e*. *t* is a universal joint connecting to the shaft *s*, the object of the shaft being to carry the actuating handle to the right side of the machine and the paper carrying devices to the left-hand side. *v* is a spring, which serves to press the rubber wheel *w* against the under surface of the wheel *u*, which also may be covered with rubber. *w'* is the handle by which to rotate the disk *u*, shaft *s*, worm *p* and roller *e*.

The mouth of the speaking-tube may be closed, except a horizontal slot, through which the vibrations of the voice pass to the diaphragm or tympan, the object of the slot being to increase the power of the hissing consonants; also, the point *b* may be dispensed with on very short lines.

In this specification no claim is made to the use of a spring for carrying one of the electrodes, since that invention forms the subject matter of an application, Serial No. 194,456, filed as a division hereof.

I claim as my invention:

In a telegraphic apparatus operated by sound, the combination, with the diaphragm, of one or more contact points of plumbago or similar inferior conductor in the electric circuit, whereby the rise and fall of electric tension is proportionate to the pressure exerted upon the said point or points by the diaphragm, substantially as set forth.

The descriptive part of the specification of patent No. 474, 232 is the same as that of patent No. 474,231, and contains the following claim:

"A spring forming or carrying one electrode of the circuit of a telephone and constantly pressing against the other electrode and diaphragm to maintain the required initial pressure between the electrodes and yield to the movement of the diaphragm, substantially as described."

The inventions contained in these several patents have been patented in foreign countries, as follows: In England, July 30, 1877, No. 2,909; in Canada, October 20, 1877, No. 8 026; in France, December 19, 1877, No. 121,687; in Belgium, January 11, 1878, No. 43,984; in Austria-Hungary, January 15, 1878; in Italy, January 19, 1878, No. 9,761; in Germany, January 23, 1878, No. 14,308; in Spain, May 6, 1878, and in Russia, February 15 and 27, 1882, No. 1,161.

The original applications upon which the patents just issued are based were filed in the United States Patent Office in 1877.

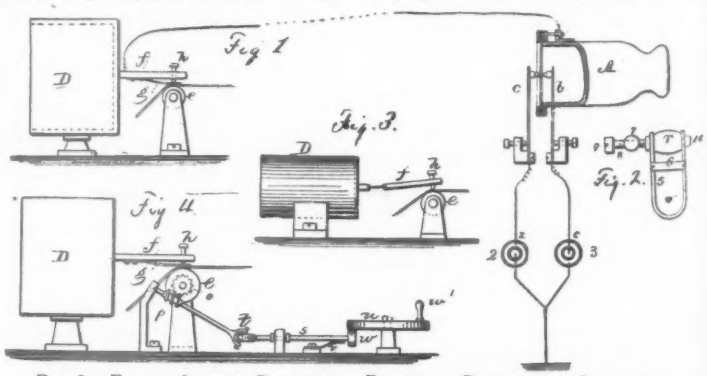


FIG. 2.—EDISON CARBON TELEPHONE PATENTS.—DIAGRAMS OF PATENTS NOS. 474,231 AND 474,232.

New England Telephone and Telegraph Company.

The annual report of the New England Telephone and Telegraph Company for the year ending December 31, 1891, shows:

	1891.	1890.	1889.
Gross	$1,559,945	$1,383,667	$1,255,370
Expenses	1,189,722	1,045,037	957,305
Net	369,622	338,630	298,265
Dividends	338,630	298,265	270,726
Surplus	30,992	40,365	27,539
Accumulated surplus	212,122	181,130	140,765

Total number of subscribers December 31, 1891, 22,972, against 21,967 in 1890, being a net gain of 1,028 exchange subscribers and a loss of 13 private line subscribers. The expenditure upon plant and equipment during the year was $908,897, against $765,353 previous year.

There was charged to new construction $487,417, of which $141,722 was for underground work, $165,506 for aerial work, $70,380 for toll lines, $190,107 for switchboards and other equipment. The last item represents the balance of stock for new equipment after charging off $65,790, consequent upon breaking up the old Boston switchboard.

The length of underground wire in Boston at the close of the year was 707,680 miles, there being but one city in the country with greater mileage.

The total mileage of exchange wire December 31, 1891, was 27,586 miles, against 23,037 miles in 1890. The average number of exchange connections daily was 128,111, against 103,286. The average number of calls per subscriber was 6¾, against 5¾ a year ago. In Boston the average number of calls per subscriber was 12.

The directors recommend the issue of a fourth series of $500,000 six per cent. 15 year bonds, and estimate the expenditures, maintenance and extension during 1892 at $712,000.

The Varley Bell.

One of the most annoying incidents arising in the use of electric bells is due to the deposition of dust at the contact points of the automatic circuit breaker which controls the vibrating mechanism. Numerous attempts have been made to make bells dust-proof, as the most common source of interference with their action finds its origin in this cause. Mr. Richard Varley, Jr., electrician of the International Okonite Company, has addressed himself to the task of removing this source of annoyance. His bell is illustrated in the accompanying engravings. The contact spring attached to the armature is flattened and slightly concaved or dished at the point where the fixed contact strikes it upon retreat of the armature. A short

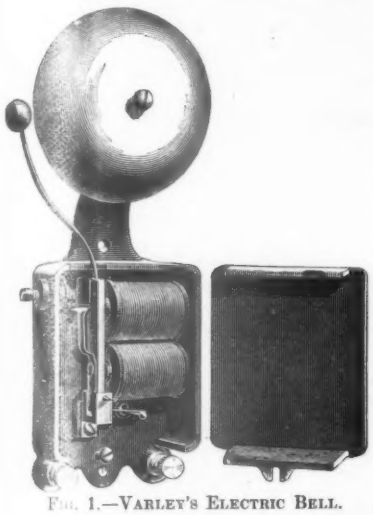


FIG. 1.—VARLEY'S ELECTRIC BELL.

piece of very thin rubber tubing is slipped over the flattened spring and the fixed contact is provided with a head (see Fig. 2) which is forced through a small hole in the rubber. This construction permits the necessary vibration to maintain the bell in operation, and the rubber hugs the spring strip so closely at all points around the dished portion that it effectually prevents the entrance of dust. The rubber is treated to a substantial coating of paraffine which prevents deterioration under atmospheric exposure. Great difficulty was found in making a hole in the thin rubber tube which would permit the headed contact to be forced through and still close over the stem behind the contact and make the connection dust tight. When the hole was punched it was either too large, or roughnesses in its walls permitted it to tear in being stretched over. If a pin hole were made it was difficult to find it, and so much time was required to mount the parts that the expense of the bell was materially increased. The difficulty was surmounted in a very ingenious way. The rubber tubing is cut into sections of the proper length and threaded over a fine copper wire, an operation which may be performed with great dispatch. One end of the wire is permanently connected with one pole of a storage battery and the circuit is closed through the wire for an instant after a sufficient number of the sections are strung. The wire is brought up to a high heat which softens the walls of the sections immediately around the wire and vulcanizes them. The heat being almost instantaneously generated and cut off leaves the walls around the hole perfectly homogeneous and elastic, and it is found that the heat of the stationary contact may be forced through it without difficulty.

Another novel feature of the bell is in the manner of mounting the stationary contact. In bells as ordinarily constructed, this contact is screwed through a piece of hard rubber or similar insulating material, and the pounding of the armature, when the bell operates, loosens the screw, thus resulting in a disturbance of adjustment and causing the bell to fail to operate. Mr. Varley overcomes this difficulty by using a soft rubber plug as a support for the adjusting screw. The central hole in the plug is slightly smaller than the size of the screw, so that when the latter is adjusted it is firmly locked in position by the elastic pressure of the walls of the plug. The bell is manufactured by J. Jones & Son, 39 Vesey street, New York. The Central Electric Company, of Chicago, will handle it to the exclusion of all other types of bell throughout the West. The sealing against dust being established at the points of contact, the bell may be made in skeleton form. As shown in the engravings, it is provided with a detachable cover; this is merely a concession to the trade, which has been obliged heretofore to use covered bells, because that was the only form then accessible with any claim to being dust-proof. As soon as the inertia of ultra-conservatism is overcome it is intended to make them in skeleton form, which has decided advantages. For example, a cover is said to make an inviting nest for croton bugs and other vermin which like to hide in dark corners. The bell is carefully constructed throughout. Particular attention has been taken to durably insulate the points requiring insulation, and establish good metallic connections in order to prevent the *tired feeling*, so to speak, noticeable in bells after protracted use. This is, in many instances, due to the ground contact caused by oxidation at a poor joint, covered, it may be, by a drop of lacquer put in the wrong place by a careless boy.

American Institute of Electrical Engineers.

The annual meeting of the Institute for the reception of yearly reports, the election of officers and other business of a similar character, will be held at the headquarters of the Institute, No 12 West 31st street, at 4 P. M., Tuesday, May 17. It is expected that the session will occupy about two hours. After adjournment, those who desire to do so will assemble at "The Arena," 41 West 31st street, where a subscription dinner will be served, the price of which has been fixed at two dollars per plate. This will be a purely social gathering, and it is hoped that all who can do so will be present.

The general meeting will be held at the Grand Pacific Hotel, Chicago, on Monday, Tuesday and Wednesday, June 6, 7 and 8.

The annual meeting and dinner, May 17, is for members and invited guests only. All sessions of the general meeting at Chicago will be open to the public, and a general invitation to all who are interested in electrical progress to attend this meeting, which, on account of the various topics to be considered, will be of great interest, has been extended to cover the dates of June 6, 7 and 8. Those who are not at present members of the Institute, but who desire to attend, are requested to send their names to R. W. Pope, secretary, 12 West 31st street, in order that they may receive copies of the official programme and secure the privilege of reduced rates of transportation in case the necessary arrangements are perfected.

The following papers are in preparation for that occasion and others are promised, which will be announced in the regular programme to be issued later:

"Electric Coal Mining Machinery," by Elmer A. Sperry, of Chicago. "On the Electro-Magnetic Field," by M. I. Pupin, Ph. D., of Columbia College, N. Y. city. "Long Distance Transmission for Lighting and Power," by Mr. Charles F. Scott, of Pittsburgh, Pa. "A New Rheostat," by Mr. C. E. Carpenter, of Minneapolis, Minn. "A Dynamo Indicator or Instantaneous Curve Writing Voltmeter," by Prof. George S. Moller, of Cornell University, Ithaca, N. Y. "Electro-Technical Education," by Prof. R. B. Owens, of the University of Nebraska, Lincoln, Neb. "The Magnetic Properties of Sheet Iron," by Mr. Milton E. Thompson of Cornell University, Ithaca, N. Y. "Selective or Individual Signals," by Mr. Thomas D. Lockwood, of Boston, Mass. "Railroad Train Lighting," by Mr. A. H. Bauer, of Chicago. "A discussion of Circuits Containing Resistance, Self-Induction and Capacity," by Messrs. Frederick Bedell and Albert C. Crehore, of Cornell University, Ithaca, N. Y. "A Life and Efficiency Test of Incandescent Lamps," by Prof. B. F. Thomas and Messrs. P. Martin and R. H. Hassler, of the Ohio State University, Columbus, Ohio. "Notes on Wiping Contact Methods for Current and Potential Measurement," by Prof. B. F. Thomas, of Columbus, Ohio. "Series Electric Traction," by Mr. Nelson W. Perry, of New York city. "Oil *vs.* Air as Insulation," by Dr. J. B. Williams, of New York city. "On the Electrolytic Refining of Copper," by Lieut. F. B. Badt, of Chicago. "The Photography of Alternating Current Curves,"

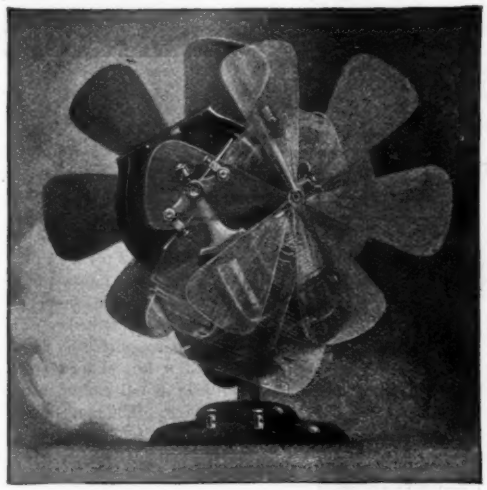
FIG. 2.—VARLEY'S ELECTRIC BELL.—DETAIL OF CONTACT POINT.

by Dr. Edward L. Nichols, of Cornell University, Ithaca, N. Y. "The Reversal of Polarity in Plating Dynamos"; also on "Dynamos for Continuous Current Circuits," by Prof. Harris J. Ryan, of Cornell University, Ithaca, N. Y. "The Technical Education of the Electrical Engineer," by Prof. D. C. Jackson, of the University of Wisconsin, Madison, Wis.

Papers are also expected from Mr. H. Ward Leonard, Mr. Nikola Tesla, Prof. Elihu Thomson and Prof. Geo. D. Shepardson, the subjects of which cannot be announced at present.

Crocker-Wheeler Pivoted Fan Motor.

An electric fan motor of novel design has been brought out by the Crocker-Wheeler Electric Company, of this city. The illustration on this page gives a good idea of it. The motor is pivoted and is mounted upon a red wood base. The unique feature is that when the motor is in operation it swings around on the pivot, describing a circle, and distributing a current of air over a much larger area than is possible with a rigidly mounted fan. This fan is equipped with the Crocker-Wheeler variable speed switch which enables the user to turn on a zephyr or a cyclone at pleasure. These outfits are supplied in sizes of one twelfth horse-power, 115 volts, and one-sixth horse-power, 115, 230 or 500 volts. The one-sixth horse-power, 500 volt size has but one speed. All motors have self-oiling bearings. A number of orders for the Crocker-Wheeler pivoted fan motors have already been booked, and it looks as if the demand would be a large one.



THE CROCKER-WHEELER PIVOTED FAN MOTOR.

TELEGRAPHIC

.... Chico, Cal., is to have a central telephone exchange.

.... The Western Union Telegraph Company will probably lay a cable from Newport to Conanicut, R. I., soon.

.... The Western Union will not move its Chicago office from the present location at La Salle and Washington streets.

.... The Montreal Telegraph Company has paid a two per cent. dividend, amounting to $40,000. This is the 111th dividend declared by the company.

.... The Western Union Telegraph Company has bought from the Chicago Board of Trade the exclusive control of the quotations which this board issues every minute. The price paid is $10,000 per annum.

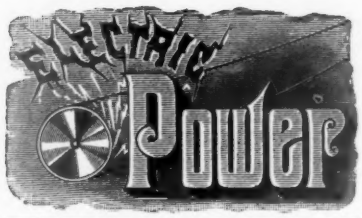
.... W. C. Page, for many years the manager of the Western Union telegraph office in Palmyra, N. Y., has resigned his position on account of the duties of his office, that of superintendent of the Empire State Telephone Company. Ernest H. Brown has been appointed manager in his place.

.... During the cattle war just ending in Wyoming the cattlemen cut the wires, thus preventing communication between Buffalo and Douglass. The lineman who was sent out to repair these breaks, so it is reported, found many feet of wire cut out and hidden, some of it being buried. He resorted to the barb wire fence, splicing the regular wire with sections of the barbed wire cut from the fences.

.... The Gold and Stock Telegraph Company put the following new prices for its ticker service in New York into effect last week: For the territory south of and including Chambers street, $20 per month; between Chambers and Fifty-ninth streets, including Fifty-ninth street, $25 per month; north of Fifty-ninth street to the Harlem River, $30 per month, except to members of the Stock Exchange.

.... William O. Ross, a small stockholder in the Western Union Telegraph Company, thinks that organization made a bad bargain when it guaranteed that the Great Northwestern Telegraph Company, of Canada, should pay the Mutual Telegraph Company $165,000 a year for its lines. For the first time since the agreement was made the Western Union has been called upon to pay $41,250 as one quarter's rent, which the Great Northwestern failed to pay, and Mr. Ross has brought suit to prevent this, on the ground that the Western Union had no legal right to enter into the agreement.

.... The efficiency of the Western Union Telegraph office at Albany was never put to a higher test than during the February convention and at that just closed. During the February convention 200,000 words were sent out, exclusive of the regular routine business, which at that time was particularly heavy. During the Republican Convention about 200,000 words were transmitted to newspapers, the greater part going to the New York city papers and, considering the nature of the chirography of many of the correspondents, with commendable accuracy. The service to the *Times* during the Winter has been exceptionally good. Since the first day of January not more than half a dozen errors—and those of the most unimportant character—have occurred in the 200,000 and more words, covering more than 100 columns of type, transmitted between Albany and New York. Under the management of Manager M. L. Morgan and Night Manager Henry V. Shelley, the reputation of the Albany office, which has always been of the first-class, has been well sustained.—*New York Times.*



* * The town of Creede, Colo., which had no existence a few months ago, is to build an electric railway forthwith.

* * The Ft. Wayne and Elmwood, Ind., Electric Railway Company will have a funeral train as a part of its equipment.

* * An electric street railway, connecting the towns of Urichsville and Dennison, O., will be built within the next three months by a Pittsburgh firm of contractors on their own capital.

* * Mayor Grote, of Elgin, Ill., State Senator H. H. Evans and County Clerk A. M. Beupre, of Aurora, T. E. Ryan, of St. Charles, President Egan and Director Gardner, of the Chicago, St. Paul and Kansas City Railroad, have applied for articles of incorporation for the Elgin, Aurora and Fox River Electric Railway; capital, $400,000. It is to run from the north to the south line of Kane County, through Carpentersville, Dundee, Elgin, St. Charles, Geneva, Bateville and Aurora. It is expected to begin constructing this year.

FIG. 1.—THE ACTORS' FUND FAIR.—OUTSIDE VIEW OF ARCH SURMOUNTED BY DESIGN COMPOSED OF MINIATURE EDISON LAMPS.

* * The Newton & Boston Railroad began the construction last week of a line from Newtonville through Newton Highlands to Newton Upper Falls, Mass. The cost of the road will be $150,000, of which $100,000 will be raised by an issue of stock and $50,000 by the sale of bonds. The president of the company is also president of the Newton & Waltham Street Railroad Company, the traffic on which line is increasing at the rate of 35 per cent. per month. For the year ending September 30 it carried 1,000,000 passengers. The Newton & Boston road may ultimately be extended through Newton Center to Chestnut Hill to a connection with West End.

The Actors' Fund Fair.

BEAUTIFUL DECORATIVE ELECTRIC LIGHTING EFFECTS.—AN ARTISTIC TRIUMPH SCORED BY THE EDISON COMPANY.

The metropolitan newspapers during the past week have devoted many columns to the general features of the Actors' Fund Fair, which was open from May 2 to May 7, in the Madison Square Garden amphitheatre. It is unnecessary to state that the fair was a complete success and that the objects for which it was held were achieved. It is the province and the pleasure of the ELECTRICAL REVIEW to deal with the beautiful electric lighting effects which were there displayed.

The most vivid impression of a symmetrical combination of color, light and form, that the writer has experienced was that obtained at the threshold of the immense amphitheatre. The floor of this immense hall was covered with booths and models of famous theatres and buildings, beautifully designed and constructed under the supervision of Mr. Stanford White, the well known architect. A main street ran down the middle of the hall, and a wide passageway was left on the curving sides. Among other buildings represented were Dickens' "Curiosity Shop," Booth's Theatre, and the Old Chambers Street Theatre. The color scheme was artistically beautiful and well executed, and not a little of the success of Mr. White's plans, and, in fact, of that of the Fair itself, was due to the electric lighting effects produced under the combined efforts of the Edison Lamp Works, of Harrison, N. J., and the Edison Illuminating Company, of New York. To Messrs. Page, Howell and Smith, of the companies named, great credit must be given for opening the eyes of the metropolitan public to the decorative possibilities of the electric light.

In the first place, every light which belonged to the regular equipment of the Garden was playing in full brilliancy. The long girders which support the roof beamed with lines of light, and the clusters of lamps along the sides of the hall contributed their share to the brilliancy of the effect. The plan adopted by Mr. Page in lighting the booths and streets of the miniature town called for a multitude of small units of light. There were in use in the many designs, candelabra and other lights, about 8,000 Edison incandescent lamps, ranging in candle power from one to ten. These lamps were all run in series. It was a bold undertaking on the part of Mr. Page to attempt such a feat as this with small units of light, but the fact was demonstrated beyond doubt that Mr. Page's method is the correct one, and a precedent for decorative electric lighting effects has been established.

FIG. 2.—THE ACTORS' FUND FAIR.—INSIDE VIEW OF ARCH SHOWN IN FIG. 1.

Every design shown was entirely new and many of the lamps in use had never before been experimented with outside of the Edison Lamp Works. Probably the most prominent and most complicated design was that over the west end of the main street. It represented a spider and a fly in a web supported by flowers, the design being of a fan shaped form. Over 1,300 lamps of small candle-power were used in this design. The lamps were controlled by a special switch designed by Mr. Page, in which great flexibility was obtained. Almost instantaneously a large number of changes could be effected and a considerable number of color combinations could be made. The candelabra lights in the booths were many of them covered with lace and silk shades, the counterfeiting of candle-light being almost perfect. One of the most novel and catching designs was that of a pin wheel operated by a motor and carrying four changes of colors. This was placed above the booth presided over by Miss Georgia Cayvan and served as a drawing card.

In the jewelry booth were three signs, that of "Diamonds" being made of white lamps on a black ground, "Rubies" in red lamps, and "Pearls" in white lamps with opal globes. What Mr. Page considers the most artistic design exhibited was that of a bunch of grapes over the wine booth. This was composed of purple lamps of various shades, and to a casual observer it was difficult to decide whether the grapes were real or not. At the east end of the main street was a very red lamps. Another handsome design was that over the booth of the Actors' Order of Friends, which was in monogram style.

The current used was supplied by the Edison plant in the Madison Square Garden building and by the Edison Illuminating Company from its street mains. All the bulbs of the lamps were of natural colors. The work here exhibited was merely a sample of what the Edison Company can do in this line, and Mr. Page promises that more surprises are in store for lovers of decorative effects. The plans conceived and carried out by the able representatives of the Edison Company have placed that company in the van in this particular line of work. The illustrations on these pages show a few of the many designs used.

* * The Baltimore, South Baltimore and Curtis Bay, Md., Electric Railroad is nearly completed, and is expected to be in operation in a few days.

* * Douglass Burnett, secretary of the Department of Physics of the Brooklyn Institute of Arts and Sciences, read a very interesting paper on "The Electric Trolley and How It will Benefit Brooklyn," before the Department of Electricity of the Institute, last week, in the lecture hall of the Y. M. C. A. building.

* * An electric railway is to be built at Bangkok, Siam. The existing horse car line is 6 miles long, 30 inch gauge and laid with 45 pound rails. The contract for electrical equipment, including an engine, two 65 horse-power generators and six cars, with a 20 horse-power motor to each car, has been awarded to the Short Electric Railway Company, of Cleveland, O.

The Incorporation of the General Electric Company.

The Act of the Legislature incorporating the General Electric Company has attracted considerable attention in the leading newspapers and among corporate interests. It was a new departure in law making in the State of New York, and is a recognition of the fact that more liberal laws are required here to prevent the exodus of capital to New Jersey, Connecticut, West Virginia, Maine and other convenient and more liberal States.

This new law, which is entitled "An Act to incorporate the General Electric Company," bears the names of Joseph P. Ord, S. Endicott Peabody, Frank S. Hastings, James Jackson, S. Dana Greene and Eugene Griffin, and is for their benefit and their associates, successors, etc., and is to enable them to carry on a manufacturing business, and to enable them to use or control electrical apparatus for any purpose.

FIG. 3.—THE ACTORS' FUND FAIR.—ONE OF THE ILLUMINATED SIGNS IN THE JEWELRY BOOTH.

The amount of capital stated in the bill was to be from $100,000 to $50,000,000. Since the passage of the law the capital of the General Electric Company has been declared to be $50,000,000, and in accordance with the provisions of the law one-twentieth of one per cent. of that capital, $25,000, has been paid into the State treasury. This amount may probably be considered a clear gain to the State, for had not the act in question become a law the company would have been incorporated in some other State.

The provisions in detail of the act give the General Company many valuable and far-reaching rights. It can acquire patents and contrivances, manufacture every kind of electrical devices, buy and sell the same, has the right to control, operate or purchase other factories connected with its business, to issue bonds, etc.

Nothing in the act is to confer any authority to maintain or operate any telephone or telegraph lines, or lines for the distribution of electricity in any of the streets or highways of the State. It is evident from this that the charter is intended for the use of a manufacturing company, organized on a broad gauged basis, and not for the purpose of owning and operating local lighting and power companies, etc.

In a section of this bill appears a provision which is of particular value to the company as severing the red tape which, as a rule, surrounds such matters, and is evidently the product of a skillful and able attorney. In abstract the section is as follows: The rights and privileges granted to said corporation (the General Electric Company) shall not be controlled or restricted by any existing statutes of the State; but so far as such statutes are or may be inconsistent with the provisions of this act, they are and shall be deemed to be altered and amended so far as they are applicable to this corporation, so as to conform to the provisions of this act, which provisions shall be in lieu of all provisions in said statutes relating to the same subject; in other respects, the corporation to be subject to the law of the State.

In conversation with a prominent corporation lawyer of the city, the REVIEW representative was told that the effect of the passage of this law would have a very material influence in preventing capital from leaving the State of New York. Companies with capital aggregating several millions have been organized in the past two or three years, under the laws of the State of New Jersey, and all of these could have been retained in New York had our State laws been more liberal. As a result of the influence of the work done upon the bill for the General Electric Company, three or four laws were passed at the recent session of the Assembly with a view to extending more liberal treatment to corporations, and the idea is quite general that the success of the Electric Company in this respect will lead to a very material modification of the strict laws of New York.

The management of the General Electric Company will be presumably from 620 Atlantic avenue, Boston, although the headquarters of the company, under the law, will be somewhere in this State, probably at Schenectady.

FIG. 4.—THE ACTORS' FUND FAIR.—ILLUMINATED DECORATIVE SIGN AT THE TEA BOOTH.

In the *Boston News Bureau* of Saturday appears the following statement: "The General Electric Company will make contracts with the Thomson-Houston and the Edison Company to become selling agents of electrical apparatus until consolidation of all interests can be effected."

—— The corner stone of the new Sunday school hall of the Nostrand avenue Methodist Episcopal church, Brooklyn, was laid one evening recently by electric light.

A Souvenir from the Brush Electric Company.

A handsome souvenir pamphlet has been issued by the Brush Electric Company, of Cleveland, O., descriptive of the incandescent Brush lighting plants installed in six of the largest office buildings in the country, belonging to the New York Life Insurance Company, and located at Kansas City, Omaha, Minneapolis, St. Paul, Montreal and New York city. The plant at Kansas City is operated by six Brush compound wound dynamos having a capacity of 2,400 sixteen candle-power incandescent lamps controlled by 36 circuits having double pole switches, so arranged that the engineer in charge can control the lighting of the entire building from the dynamo room. The plant at Omaha has a capacity of 1,600 sixteen candle-power lamps; that at St. Paul, 1,200; that of Minneapolis, 2,500; of Montreal, 1,000; of New York city, 1,200. The pamphlet is a magnificent specimen of the engraver's and printer's arts, bound in a handsome illuminated cover. Aside from the interesting details it contains of the lighting equipment of these great buildings mentioned, it is of artistic interest for the magnificent specimens of architecture it illustrates. The interior views are particularly fine, being large quarto engravings and half tones, bringing out in strong relief the beautiful details of the interior finishings of these noble buildings. The pamphlet contains, also, fine views of the Grand Hotel, Yokohama, Japan; Hotel Fuji, Mianoshita, Japan; and the United States Cruiser "Boston," which are all equipped with Brush lighting plants; and fine illustrations of a Brush arc dynamo for sixty-five 2,000 candle-power arc lamps; Brush alternating current generator; Brush colossus generator for 6,000 incandescent lamps of 16 candle-power each, and a Short electric railway generator.

—— The Livingston, Mont., Electric Light Company are making arrangements to move their plant to a point about one mile west of the city. This is done in order to enable them to use water power in place of steam.

ELECTRIC LIGHT NEWS

—— Wapakoneta, Ohio, will install a $20,000 electric light plant.

—— Steps are being taken to light Reisterstown and Glyndon, Md., with electricity.

—— Incandescent electric lights may be substituted for gas at Burlington, Ia., for street lighting.

—— Local capitalists have purchased the Thomson-Houston electric light plant at Brockport, N. Y.

—— Hatboro, Pa., citizens are examining into the cost of electric lighting, with a view to introducing it in that town.

—— The governing committee of the Boston Stock Exchange has admitted to the regular list the stock of the Boston Electric Light Company.

—— The Connecticut Electric Company, of Waterbury, has increased its capital from $150,000 to $200,000, the increase being subscribed in cash.

—— During an electric storm which passed over Pittsburgh, last week, the Allegheny County Electric Light Company had seven dynamos burned out.

—— The Thomson-Houston Carbon Company, of Fremont, O., has received the $35,000 bonus offered by the city if it would rebuild its recently burned plant in Fremont.

—— Negotiations are now being completed by which the Manitou electric light plant will be moved to Colorado Springs, Colo. The plant will do service for both towns.

—— The plans for the new buildings of the Thomson-Houston Electric Company have been received at Lynn, Mass. The plans call for four structures each from 100 to 300 feet long and it is proposed to commence work on them this month.

—— Work on the introduction of the electric light in the Vatican at Rome has begun. The grand staircase is to be splendidly illuminated upon occasions of state. There is already an elevator in the Vatican, and the Pope has a telephone convenient for use.

—— Lee Mantle has commenced suit at Butte, Mont., against the Silver Bow Electric Light Company for damages alleged to have been sustained a year ago, when Mr. Mantle was struck on the head in a steam pipe explosion at the electric light plant. Mr. Mantle is one of the stockholders of the company which he is suing.

—— Morris Rassmusen, night foreman at the suburban electric light station, in Elizabeth, N. J., was missed at 3 o'clock one morning last week by Engineer James Ross. A little later he was found dead on his knees in a narrow passage behind the boiler. His face was buried in a pile of soot, and there was a bruise on his forehead. It is supposed that he stumbled and was stunned by striking his head against an iron valve in the passageway and was then suffocated in the soot.

—— A special meeting of the stockholders of the Edison Electric Illuminating Company, of New York, will be held May 31 to take action upon a proposition to increase the capital stock of the company from $4,500,000 to $6,500,000, for the purpose of extending the present business of the company, and also to take action upon a proposition to authorize the issue of $1,000,000 additional bonds under and pursuant to the provisions of this company's mortgage or deed of trust dated March 4, 1890, to the Central Trust Company, of New York, as trustee, and to act upon other matters connected with the extension of the company's business.

KINDRED INTERESTS

T. W. Ness, dealer in electrical supplies, has removed from 644 Craig street to 749 Craig street, Montreal, Canada.

It is reported that the General Electric Company may build a manufacturing plant on the Pacific Coast. Tacoma, Wash., is mentioned as a probable location.

George H. Thurston & Company, Providence, have purchased the electrical house furnishing department of the Rhode Island Electric Protective Company.

The Wenstrom Consolidated Dynamo and Motor Company's plant at Baltimore, Md., was offered for sale at public auction last week. The highest bid was $150,000 and the property was withdrawn.

The Waddell-Entz Electric Company, of Bridgeport, Conn., has been incorporated in the State of West Virginia under the name of the Waddell-Entz Company, with $5,000,000 capital. The factories will remain in Bridgeport, but will be greatly enlarged or a new one may be built.

The New York and New Jersey Telephone Company has issued a very handsome colored folder giving information about the long distance telephone. The inside of the folder is used for a very complete map, showing the long distance connections of the New York and New Jersey Telephone Company. A list of the company's pay stations is also given.

The Cowles Electric Smelting and Aluminum Company, Lockport, N. Y., has issued a valuable pamphlet giving a great deal of information about aluminum. The company named is now making a considerable number of aluminum products, including pure aluminum, aluminum bronze, aluminum brass, manganese bronze, silver bronze, silicon copper and ferro aluminum.

The National Carbon Company broke ground at Cleveland, O., last week for the largest carbon works in the world. The buildings will cover 30 acres, and have a capacity of 15,000,000 carbons a month. The entire site comprises 100 acres, and the plant will be enlarged next year. The company will manufacture gas for its own fuel and lighting, and use the most perfect smoke consuming devices.

An Extensive Addition is being built at the already large plant of the Washington Carbon Company, at Washington, Pa. New hydraulic machinery is being placed in the factory at a cost of $10,000, and the combined cost of the improvements which are being made will approach $15,000. This has been made necessary by the increased business of the company. During the month of March 3,000,000 arc light carbons were sold and the sales last month will be even greater than that.

The Detroit Electrical Works, Detroit, Mich., are building up a large and lucrative electric railway business. Last January the Jacksonville, Ill., Railway Company purchased three of their 30 horse-power car equipments. The road was put into operation about March 1, and on May 2 the Detroit Electrical Works received an order for three more 30 horse-power car equipments. Both orders were for the standard double reduction equipments made by the Detroit Electrical Works.

The Laramie Electric, Gas Light and Fuel Company, of Laramie, Wy., M. N. Grant, president and superintendent, has contracted with the St. Louis office of the Pond Engineering Company for the enlarging and remodeling of their steam plant. A new steel boiler of 128 horse-power capacity, with stack, rocking grates and improved furnace, will be installed. The three old boilers, of 70 horse-power capacity each, will also be provided with rocking grates and improved boiler settings.

The Kerite Company is meeting with great success in Chicago in supplying wire for the mammoth new buildings being erected in that city. A picture of one of these immense structures is shown on another page, and presents a graphic and convincing feature favorable to this long-established and popular insulated wire. Mr. W. R. Brixey, the general manager of the Kerite Company, will hereafter devote a considerable portion of his time to the New York office as well as superintending the large factory of the company at Seymour, Conn. Mr. F. W. Cushing, the Chicago agent of the company, with his office at 225 Dearborn street, will, as heretofore, look after the increasing Western business of the company.

One of the Most Notable features of the World's Fair at Chicago next year will be a complete model of the entire plant of the H. C. Frick Coke Company, of Scottdale, Pa. This company employs about $40,000,000 capital in its business, and is the largest of the kind in the world. The contract has been let to the Jones Bros. Company, of 30 Court street, Cincinnati, O., who are experts in the making of models. The estimated cost of this model is between $3,000 and $4,000. The plant will occupy a space about 20x50 feet, made on a scale of one-twentieth of an inch to the foot, and will be an exact *fac-simile* of the original; including boilers, engines, piping, elevated tracks, cupolas, cars, and all other machinery, and will be in operation. The motive power will be electricity.

The Electric Merchandise Company Is No More.

Mr. W. R. Mason, who recently resigned the general managership of the Electric Merchandise Company, of Chicago, and then organized the Railway Equipment Company, has purchased the capital stock, merchandise and entire business of the Electric Merchandise Company. The business will hereafter be conducted under the name of the Railway Equipment Company, of which Mr. Mason is the general manager. A full line of every kind of electric railway supplies will be carried and orders will be promptly filled. The temporary offices of the Railway Equipment Company are at 617 to 619 Pullman Building, Chicago.

Judicial Sale of Electric Street Railway.

BARROW vs. ST. CATHARINES, MERRITTON AND THOROLD STREET RAILWAY COMPANY,

By virtue of the judgment herein and the order for immediate sale, there will be sold, with the approbation of J. E. O'Reilly, Esquire, Local Master at Hamilton, at the Grand Central Hotel, St. Catharines, on Saturday, the 28th day of May, A.D. 1892, at noon, by S. Robinson & Son, Auctioneers, the undertaking known as "The St. Catharines, Merritton and Thorold Street Railway," including the rolling stock and equipments thereof, full details and particulars of which can be obtained on application to the Vendor's Solicitors.

The undertaking consists of a valuable water-power, with the necessary machinery for generating electricity, at Merritton, over six miles of track and wires, cars, motors, office, sheds, etc. There is estimated to be a surplus of 200 horse-power over the requirements of the railway, which can be utilized for supplying power and light to manufactories, residences, etc.

TERMS: 10 per cent. on the day of sale, and the balance without interest 30 days thereafter. The property will be sold subject to a reserved bidding fixed by the Master.

Further particulars and conditions of sale may be obtained on application to T. E. Nihan, Receiver and Manager, St. Catharines, or to Bruce, Burton & Bruce, Canada Life Chambers, Hamilton, or to

NESBITT, BICKNELL & GAULD,
VENDOR'S SOLICITORS,
Canada Life Chambers,
Hamilton.

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LOCAL MASTER AT HAMILTON.

ELECTRICIAN WANTED.

Practical young man to take charge of complete small plant, ready for business, in connection with long established machine concern. Repair work and new work—good field—CHANCE TO GROW.

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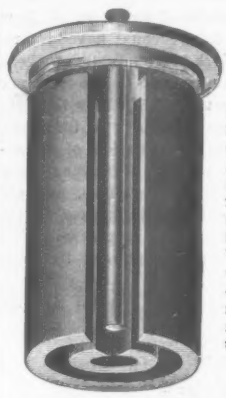

THIS is a cut of the Law Battery Double Cylinder Carbon Element attached to cover with zinc. It has 147 square inch carbon surface. The element is everlasting and is so guaranteed. Why use a battery with a chemical depolarizer that needs frequent renewal of the negative element?

LAW BATTERY COMPANY,
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Robb MacKie,

CONSULTING ELECTRICAL ENGINEER,

Neave Building,

CINCINNATI, O.

THE LEHIGH VALLEY

CREOSOTING CO.

WORKS, PERTH AMBOY, N. J.
Office, Foot of Washington Street, JERSEY CITY, N. J.
Creosoted Lumber, Underground Conduits. Telegraph Poles, Piling and Ties Furnished.

MACHINERY IN STOCK.

Engine Lathes, 10 in. x 4 ft.; 11 in. x 5 ft.; 12 in. x 6 ft.; 14 in. x 6 ft.; 16 in. x 6 ft.; 18 in. x 8 ft.; 20 in. x 8 ft., with tapes attachment; 22 in. x 12 ft. and 14 ft.; 24 in. and 26 in. x 16 ft.; 30 in. x 10 ft. and 18 ft.; 36 in. and 38 in. x 20 ft.; 42 in. x 12 ft.; 27 in. x 32 ft.; 88 in. x 31 ft.; 96 in. x 20 ft. Fox Lathes, 13 in. x 5 ft.; 14 in. x 5 ft.; 15 in. x 6 ft.; 18 in. x 6 ft. Turret Lathes, 12 in. x 5 ft.; 14 in. x 5 ft.; 15 in. and 16 in. x 6 ft.; 18 in. x 6 ft.; 36 in. x 8 ft.

Planers, 16 in. x 16 in. x 3 ft.; 20 in. x 20 in. x 4 ft.; 24 in. x 24 in. x 6 ft.; 30 in. x 30 in. x 6 ft.; 36 in. x 36 in. x 10 ft.; 42 in. x 42 in. x 12 ft.; 44 in. x 48 in. x 22 ft.; 60 in. x 49 in. x 24 ft.

Friction Shapers, 15 in., 16 in., 20 in., 22 in., 32 in.

Crank Shapers, 6 in., 8 in., 10 in., 13 in., 13 in., 16 in., 17 in., 20 in., 24 in., 28 in.

Screw Machines, Nos. 1, 2, 3, 4, with or without Wire Feed.

Screw Machines, Nos. 5, 6, 7, 8, Power Feed.

Presses, Nos. 51, 52, 53, Ferracute; Nos. 1, 2, 3, Stiles & Parker.

5 Lincoln Pattern Millers, No. 2.

Hand Millers, Nos. 1 and 2. 3 Cam Cutters.

Bolt Cutters, ¼ in. to 1 in., ½ in to 2 in.

2 Profiling Machines. 1 36 in. and 48 in. Gear Cutter.

C. D. and E. Horizontal Boring Machine. Newark Machine Tool Co.

Send for List of New and Second-Hand Machinery in Stock.

PRENTISS TOOL & SUPPLY CO., P. O. Box 3362,
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59 South Canal St., Chicago, Ill.

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STRONGER than any Open Circuit Battery on the Market. **BETTER** than any other Dry Battery yet produced. Most compact in size and cheapest. 90 cents per cell. Discount to the Trade and in quantities.

J. H. BUNNELL & CO.,

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INCANDESCENT WIRING HAND-BOOK, - - - - - By *Badt*
THE DYNAMO, - - - By *Bottone*
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